

HANDBOOK
OF
INTESTINAL SURGERY

L. A. BIDWELL

*Library of the School of Medicine
University of Leeds*



*From the library of
The Right Honourable Lord Moynihan
of Leeds*

1865 — 1936

Professor of Surgery



30106

004195508

STORE
Wt 1180
610

A HANDBOOK
OF
INTESTINAL SURGERY



Digitized by the Internet Archive
in 2015

<https://archive.org/details/b21517411>

A HANDBOOK

OF

INTESTINAL SURGERY

BY

LEONARD A. BIDWELL, F.R.C.S.,
SURGEON WEST LONDON HOSPITAL; LECTURER ON INTESTINAL SURGERY, AND
DEAN OF THE POST-GRADUATE COLLEGE; CONSULTING SURGEON TO THE
BLACKHEATH AND CHARLTON AND DISS HOSPITALS, ETC.

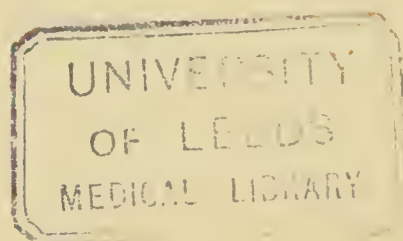


LONDON
BAILLIÈRE, TINDALL AND COX
8, HENRIETTA STREET, COVENT GARDEN

1905

[All rights reserved]

603706



P R E F A C E

THIS little volume aims at giving such a precise description of the commoner intestinal sutures that an inexperienced surgeon may readily practise the various methods on dead intestine before performing an anastomosis on the living subject.

The book owes its origin to the establishment of a class in intestinal surgery at the West London Post-graduate College, and it contains a full description of the work done in this class. The material which I use for these classes is the small intestine of bullocks, which I am fortunate enough to obtain the day the animal is killed. Bullock's intestine is of practically the same thickness as that of man, and if used quite fresh resembles to the touch and in resistance the intestine of a living man much more closely than does human intestine removed in the post-mortem room. It, moreover, has the advantage of being odourless and of not soiling the hands. In order to enable an anastomosis to be performed single-handed, each student is provided with a little intestine holder, which is figured on p. 43, and takes the place of a first-rate assistant. In such a book, with the aid of which, it is hoped, the student may dispense with class teaching, numerous and clear illustrations are of the first importance, and I have been very fortunate in obtaining the assistance of Dr. Leonard Mark and of my colleague,

Mr. A. Baldwin, to whose artistic illustrations much of the usefulness of the book will be due. I have to acknowledge the courtesy of my friend Mr. Watson Cheyne, and of Messrs. W. B. Saunders and Co., who have kindly allowed me to copy the diagrams which bear their names. I have also to thank Dr. Maunsell, Mr. Jessett, and Messrs. Down Bros. for the loan of a number of blocks.

The last two chapters on the preparation before and the treatment after operations are lectures delivered at the Post-Graduate College, and were originally published in the *Clinical Journal*.

L. A. BIDWELL.

UPPER WIMPOLE STREET, W.

May, 1905.

CONTENTS

CHAPTER I

	PAGES
Anatomical conditions—General considerations with regard to anastomosis—Materials required for an intestinal anastomosis—Needles—Sutures—Clamps—Varieties of suture: interrupted and continuous - - - - -	1-20

CHAPTER II

Method of closing an incised wound of bowel—The choice between a lateral and end to-end anastomosis—Lateral anastomosis by sutures alone—The management of the mesentery—Occlusion of the intestine—Halsted's operation—Lateral anastomosis by continuous suture - - -	21-35
--	-------

CHAPTER III

End-to-end anastomosis by sutures—Maunsell's method—Method by two rows of interrupted sutures—Double row of continuous sutures—Anastomosis by sutures and apparatus—O'Hara's clamp forceps—Laplace's forceps—Halsted's rubber bag—Mayo Robson's bobbin—Allingham's bobbin—Landerer's potato bobbin—Murphy's button - - - - -	36-62
--	-------

CHAPTER IV

Operations on the stomach—Suture of gastric ulcer—Gastro-enterostomy: anterior and posterior—'Vicious circle'—Comparison between different methods—Pyloroplasty—Pylorectomy - - - - -	63-80
---	-------

CHAPTER V

Operations on large and small intestines—Ileo-colostomy—Enterostomy—Colotomy - - - - -	81-89
--	-------

CHAPTER VI

PAGES

Operations on gangrenous bowel caused by hernia and internal strangulation — Operative treatment of intussusception — Treatment of artificial anus or fæcal fistula : (1) Small intestine ; (2) large intestine—Comparison of various methods —Treatment of cancer of the colon	-	-	-	90-108
---	---	---	---	--------

CHAPTER VII

Operations on the appendix vermiformis—Acute cases—Chronic Management of stump—Abdominal incisions	-	-	-	109-118
--	---	---	---	---------

CHAPTER VIII

Incisions into the abdomen, and the method of closing them— Position of the incision in various operations	-	-	-	119-124
--	---	---	---	---------

CHAPTER IX

The preparations before abdominal operations	-	-	-	125-143
--	---	---	---	---------

CHAPTER X

Treatment after abdominal operations	-	-	-	144-163
INDEX	-	-	-	165-167

LIST OF ILLUSTRATIONS

FIG.	PAGE
1. Diagram of the Coats of the Small Intestine - - -	2
2. Calyx-Eyed Needles - - - - -	7
3. Doyen's Clamp - - - - -	8
4. Lane's Clamp - - - - -	9
5. Elastic Ligature Clamp - - - - -	10
6. Maunsell's Sponge Clamp - - - - -	11
7. Lembert's Suture - - - - -	12
8. Czerny Suture - - - - -	13
9. Wölfer's Suture - - - - -	13
10. Joubert's Suture - - - - -	14
11. Halsted's Suture - - - - -	15
12. Continuous Lembert Suture - - - - -	16
13. Continuous Glover's Suture - - - - -	17
14. Continuous Cushing's Suture - - - - -	17
15. Continuous Mattress Suture - - - - -	18
16. Gely's Suture - - - - -	19
17. Purse-string Suture - - - - -	19
18. Closure of Incision in Bowel Wall, First Stage - - -	21
19. Ditto, Second Stage - - - - -	22
20. Method of Closing Wound with Loss of Substance - - -	22
21. Ditto, Completed - - - - -	23
22. The Method of Applying Two Pieces of Bowel in Short-Circuiting - - - - -	26
23. The Method of Applying Two Pieces of Bowel after Enterectomy - - - - -	26
24. Occlusion of Intestine - - - - -	27
25. Ditto, Second Stage - - - - -	28
26. Ditto, as seen from above - - - - -	29
27. Halsted's Method of Lateral Anastomosis - - - - -	30
28. Ditto, Second Stage - - - - -	30
29. Ditto, Third Stage - - - - -	31
30. Ditto, Final Stage - - - - -	32

List of Illustrations

FIG.	PAGE
31. Lateral Anastomosis by Double Continuous Sutures-	33
32. Ditto, Second Stage - - - - -	34
33. Ditto, Third Stage - - - - -	34
34. Management of the Mesentery - - - - -	36
35. Ditto, Completed - - - - -	37
36. Showing Oblique Section of the Bowel in End-to-End Anastomosis - - - - -	38
37. Maunsell's Method of End-to-End Anastomosis - - - - -	39
38. Ditto - - - - -	40
39. Ditto - - - - -	40
40. Ditto - - - - -	41
41. Ditto, Operation, Completed - - - - -	42
42. End-to-End Anastomosis by Interrupted Sutures - - - - -	43
43. Ditto, Second Stage - - - - -	43
44. Ditto, Third Stage - - - - -	44
45. Ditto, Final Stage - - - - -	45
46. Ditto, by Continuous Suture - - - - -	46
47. Ditto, by Continuous Suture, Stitch through Mucous Membrane - - - - -	47
48. O'Hara's Clamp Forceps - - - - -	48
49. Method of Performing End-to-End Anastomosis by Halsted's Suture over O'Hara's Forceps - - - - -	49
50. Laplace's Forceps - - - - -	50
51. Halsted's Air Cylinder - - - - -	52
52. Halsted's Air Cylinder in Position - - - - -	53
53. Mayo Robson's Bone Bobbin - - - - -	54
54. Ditto, in Position - - - - -	55
55. Ditto, the Suture Completed - - - - -	56
56. Allingham's Bone Bobbin - - - - -	57
57. Ditto, in Position - - - - -	58
58. Landerer's Potato Bobbin - - - - -	58
59. Murphy's Button - - - - -	59
60. Purse-string Suture round Intestine - - - - -	60
61. Method of holding Button - - - - -	60
62. Murphy's Button in Position, Mesenteric Stitch - - - - -	61
63. Closure of Ruptured Gastric Ulcer - - - - -	64
64. Ditto, Second Method - - - - -	64
65. Finding the First Part of the Jejunum - - - - -	66
66. Anterior Gastro-Jejunostomy by Halsted's Method - - - - -	67
67. Anterior Gastro-Enterostomy - - - - -	68
68. Ditto - - - - -	69
69. Posterior Gastro-Enterostomy - - - - -	70
70. Method of Performing Entero-Anastomosis - - - - -	72
71. Gastro-Enterostomy by Roux's Method - - - - -	72
72. Ditto, Completed - - - - -	73

List of Illustrations

xi

FIG.		PAGE
73.	Pyloroplasty - - - - -	77
74.	Pylorectomy combined with Gastro-Enterostomy - -	79
75.	Ileo-Sigmoidostomy - - - - -	82
76.	Paul's Tubes - - - - -	84
77.	Method of Introduction of Paul's Tube in Enterostomy -	85
78.	Colotomy, First Stage - - - - -	87
79.	Ditto, Second Stage - - - - -	88
80.	Method of Excising an Intussusception - - - - -	95
81.	Ditto, the Operation Completed - - - - -	96
82.	Dupuytren's Enterotome - - - - -	99
83.	Ditto, applied Dividing Spur - - - - -	100
84.	Incision through Parietes in Appendectomy - - - - -	114
85.	Division of Meso-Appendix - - - - -	115
86.	Cuff of Appendix Dissected Back - - - - -	115
87.	Invagination of Stump of Appendix - - - - -	116
88.	Invaginated Stump seen on Section - - - - -	117
89.	Incision through Rectus Sheath - - - - -	120
90.	Edge of Peritoneum held up for Passage of Peritoneal Sutures - - - - -	122
91.	Section of Wound in Rectus Sheath after Closure - - -	123

INTESTINAL SURGERY

CHAPTER I

SECTION I

GENERAL CONSIDERATIONS

I. Anatomical Conditions.—The small intestine has four important coats, as shown in Fig. 1. They vary in thickness and in toughness in different parts of the bowel.

1. The peritoneal coat does not completely surround the gut in any part of the intestine; there is always the portion of the circumference of the bowel at the attachment of the mesentery which is uncovered with peritoneum. The extent of this uncovered area varies in different parts. It is smallest in the ileum, where only about one-tenth of the circumference is uncovered. In the duodenum, ascending and descending colons, the portion which is not covered with peritoneum is nearly one-half of the circumference, and in the transverse colon and sigmoid the uncovered area is about one-fifth of the whole.

2. The muscular layer is the thickest coat of the bowel, and consists of longitudinal and circular fibres. Although of considerable thickness, it is not, however, of great strength, and sutures which take a hold of this coat only

Intestinal Surgery

will readily cut out. The thickness of the coat varies with the contraction or dilatation of the gut, being many times smaller in atonic distension than in normal contraction.

3. The submucous coat is not of great thickness, but it is composed of very tough fibrous tissue, and only a few fibres of this coat have a greater resisting power than

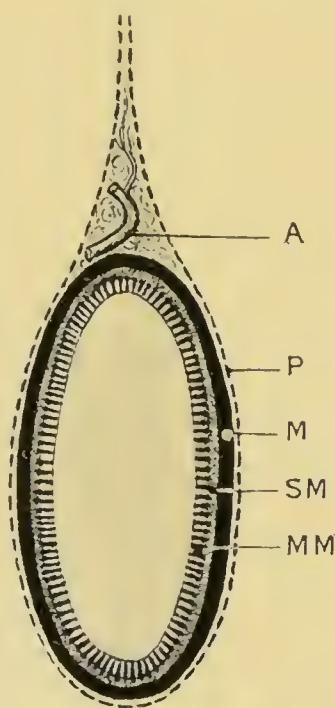


FIG. 1.—THE COATS OF THE ILEUM. (L. MARK.)

P, peritoneal coat ; M, muscular coat ; SM, submucous coat ;
MM, mucous membrane ; A, artery of mesentery.

the whole of the serous and muscular coats. It is essential, in order to secure firm union, that a portion of this coat be included in each suture.

4. The mucous membrane varies much in thickness, being thickest in the jejunum, and thinnest in the lower part of the ileum and in the large intestine. The coat is very friable, and sutures passed through this coat alone will easily cut out.

The fact that the valvulæ conniventes are present in

large numbers in the jejunum, and are absent in the lower part of the ileum, and can be easily felt through the bowel, gives us an easy way of distinguishing a coil of jejunum from one of the ileum.

To sum up, the mucous coat is the most friable, the submucous coat is the toughest, the muscular coat is the thickest, but not the strongest, and the peritoneal coat is incomplete.

The peritoneal coat, however, is of the very greatest importance, since the earliest and firmest adhesions between portions of intestine are formed between adjacent peritoneal coats. It is, therefore, essential that portions of intestines which are covered with peritoneum should be selected for an anastomosis.

In the small intestine the two sides of the mesentery are sufficiently close together that when the adjacent portions are in contact they will complete the peritoneal investment, and so end-to-end anastomosis presents no great difficulty. In the ascending and descending colon, however, the absence of peritoneal covering over one-half the circumference makes an end-to-end anastomosis a hazardous procedure.

Generally speaking, the part of the intestinal wall which unites most readily is the convex border, or that portion exactly opposite to the mesenteric attachment; this is the point selected for incision of the gut in the case of extraction of a foreign body such as a gall-stone, or for the temporary relief of obstruction. This also is the point selected for the line of union in performing a lateral anastomosis, and so it follows that a lateral anastomosis is a very safe method of uniting intestines.

II. Another point of importance is that the anastomosis should be made between equally movable portions of

gut, and it is undesirable that a movable piece of gut should be united to a fixed one, since the intestinal contractions in the movable portion of gut will cause this portion to pull upon the stitches when united to a fixed part. Thus the ileum should not be connected to the ascending or descending colon, but when it is necessary to unite it to a portion of the large intestine the union should be made with the transverse colon or the sigmoid. In the same way the only parts of the large intestine which should be united to each other are the transverse colon or the sigmoid. Again, the fixed duodenum should not be united to the movable stomach, but the movable jejunum should be employed in its place.

III. When the knots of sutures are left on the peritoneal surface of the gut, it is essential that the suture should not penetrate through all the coats of the gut, since there would then be a probability of infection of the peritoneum by absorption from the intestinal tract. It is quite a question whether the mere fact of the silk becoming infected by absorption of intestinal contents will lead to any bad effect ; the real danger lies in the fact that when once the suture has become infected it will have to separate, and it will do this in the direction of least resistance. When the knot is inside the bowel a little irritation is set up just round the suture, which effectually shuts off the peritoneal cavity, and then sufficient inflammation and ulceration are excited to cast off the suture within the cavity of the bowel, a very small tract being left after it has been discharged ; this, however, is sealed by peritoneal adhesion, and so gives rise to no trouble.

When, however, the knot is outside, and the suture has become infected, it will have to separate in the

direction of least resistance, which will be the cavity of the gut, since on the outside there is the general intra-abdominal pressure. As the knot has to traverse the whole thickness of the bowel coats, a considerable amount of ulceration is necessary to allow it to pass within the lumen, and the tract left is of a considerable size, and it is thus that extravasation may occur.

When, therefore, sutures pass through all the coats, the knot should be placed inside the bowel, and even if no supporting row of sutures be inserted, this will not lead to infection and extravasation.

IV. It is most essential to tie each stitch as tightly as possible, since a stitch which is tied sufficiently tightly when the gut is collapsed will become loose when the gut is distended, the reason being that when the bowel is collapsed the muscular coat is much thicker than when it is distended, all its coats being then thinned. It must be remembered that every injury to the intestine will produce some temporary paralysis, which is accompanied by dilatation of the part.

V. The anastomoses should, when possible, be done outside the abdominal cavity, so as to lessen the risk of infection ; this is not difficult, if only movable portions of the gut be united.

VI. A surgeon should not be dependent upon any special apparatus for the performance of an anastomosis, since the necessity for the performance will often arise in the course of some other operation when the special apparatus is not at hand. It is therefore desirable that he should first be perfect in some simple suture, and after this he can use any apparatus if he desires it.

VII. Other things being equal, the patient's chances of recovery are greatly enhanced by rapid operating, and this can only be obtained by practice.

VIII. It is almost unnecessary to impress upon the surgeon the necessity of counting all instruments and sponges employed before and after an operation.

SECTION II

MATERIALS REQUIRED FOR AN INTESTINAL ANASTOMOSIS

The ordinary instruments required are a scalpel, eighteen or twenty-four small Spencer Wells forceps, dissecting forceps (two pairs), two large abdominal retractors, one small retractor, a pair of blunt hooks (button-hooks do very well in an emergency), a needle-holder to take curved needles (as made by Krohne and Seesman), ordinary surgical needles for closing skin incision, fine silk for ligatures, silkworm gut for the wound, various sponges, round or flat, or sterilized wool mops wrapped in gauze.

The special instruments required are (1) intestinal needles, (2) clamps, (3) material for suture. It is most important to have proper needles, since, if ordinary surgical needles with sharp sides be employed, there is a great risk of the delicate coats of the intestine being cut through if the needle be held at all slantingly. Both straight and curved needles should be at hand; the straight needles are ordinary sewing-needles, which can be obtained from any haberdasher, and the most convenient size is No. 8. It is convenient to have rather a longer needle than the sewing-needle, and such a one is called a straw needle. In order to use a small-size needle, I recommend that the open-ended or calyx-eyed needle should be obtained; they save an infinite amount of trouble in threading—in fact, until I employed them, I used to find it impossible to thread No. 8 needles with

wet silk, and I had to sterilize the silk and needles together after threading—an undesirable proceeding, since the loop of silk within the needle is liable to become rotten by development of a little rust in the eye of the needle during boiling. Again, if a needle comes unthreaded in a continuous suture, it is instantly rethreaded in the case of a calyx-eyed needle. These needles have a spring eye, as shown in Fig. 2. They are threaded by simply passing a piece of silk over the end.

Straight needles are most useful in picking up the

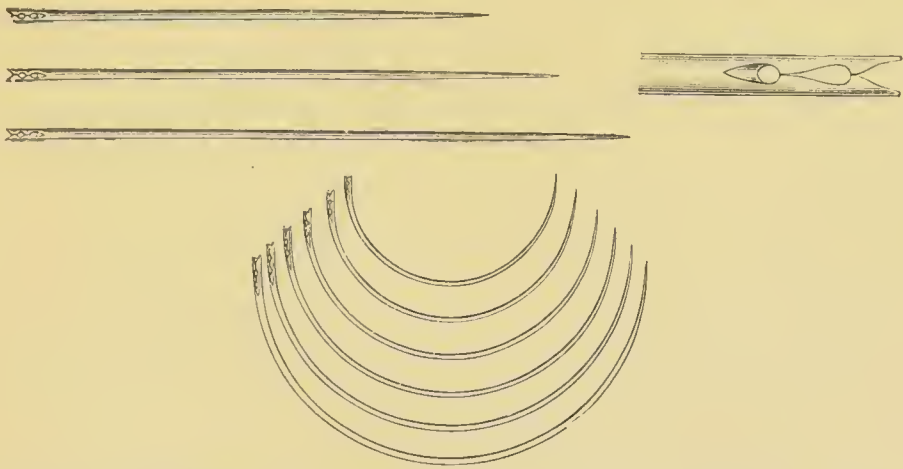


FIG. 2.—STRAIGHT AND CURVED INTESTINAL NEEDLES, WITH 'CALYX' EYE (ENLARGED SKETCH OF CALYX EYE). (DOWN BROS.)

submucous coat, since they are driven in with the pulp of the finger, and when used in this way it is easy to recognise the resistance of the different coats.

Curved needles, which must also be made round, are useful for continuous sutures, especially when an anastomosis is performed within the abdominal cavity, when straight needles could not be used so easily. I strongly advise those made with calyx eyes to be used, since it is practically impossible to thread the intestinal needles supplied by some instrument makers. The ordinary full-curved needle is the best shape, and the semicircular

ones which are often supplied are not so easily handled. I should just like to utter a warning against the use of Hagedorn's needle. The cutting edge of the needle and the large round eye make it very unsuitable for intestinal work.

Clamps

I do not propose to describe all the forms of clamps which have been recommended for intestinal work ; I shall only refer to those which I use myself. One of the best is Doyen's (Fig. 3). You will notice that the

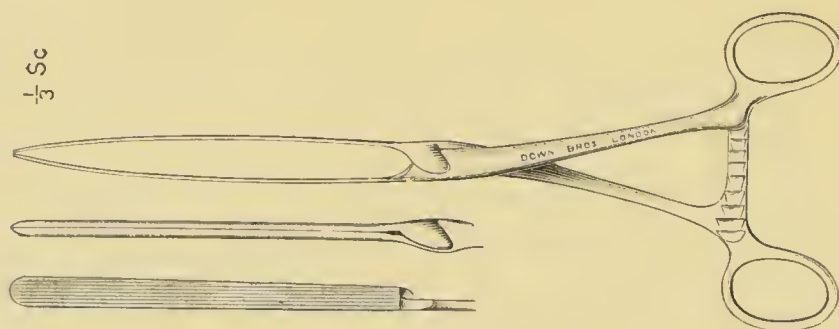


FIG. 3.—DOYEN'S INTESTINAL CLAMP. (DOWN BROS.)

blades are made with fine grooves, and are bowed so that their tips meet before the centre. In this way it is easy to regulate the amount of pressure on the gut when it is applied ; it is unnecessary to strangulate the gut, the chief use of a clamp being to prevent the passage of any intestinal contents, and so it need be only lightly applied. Two of these clamps are a useful addition to the equipment of a surgeon.

The other clamp which I employ and recommend to you is the one introduced by Mr. Arbuthnot Lane, and bears his name. It consists (Fig. 4) of a steel rod, having a blunt point at one end and a notch at its other end, to which an elastic ring is attached ; a small cap with a

notch fits on the blunt point, and when the cap is in position the elastic ring is stretched over the whole. It is applied by passing the blunt point through the mesentery close to the gut, and then applying the small cap with the elastic band attached, so that the gut is compressed between the elastic band and the rod. It is very simple and inexpensive, and two of them are useful. The application of this clamp is seen in Fig. 42.

Still, however, the most important thing is to be able to clamp the gut without any special apparatus, and the following two methods are very simple and efficacious :

1. A fine pair of Spencer Wells forceps is passed

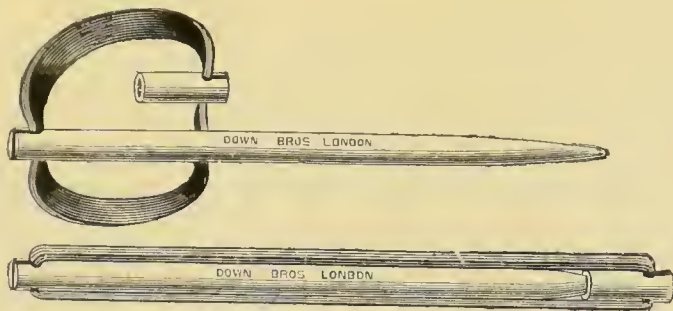


FIG. 4.—LANE'S INTESTINAL CLAMP. (DOWN BROS.)

through the mesentery close to the gut, and about 6 inches of a small-size rubber tubing (sterilized) is drawn through the hole, and the two ends of the tubing tied lightly together over the gut, with just sufficient force to obliterate the canal ; the knot, which is a single one, is prevented from slipping by applying a pair of Spencer Wells forceps as shown in Fig. 5. The constriction is easily removed by taking off the forceps. I have used this method in a number of cases, and have found it absolutely satisfactory. The constricting tubing cannot slip, as it is passed through the mesentery.

2. Maunsell's method, which consists of a piece of sponge and a safety-pin, both of which are easily steri-

lized by boiling. The safety-pin is passed first through the piece of sponge, then through the mesentery close to the bowel, and then through the sponge again, and fastened; in this way the bowel is compressed between the safety-pin and the sponge. This is shown in Fig. 6. The piece of sponge should be the same length as the safety-pin. It is a

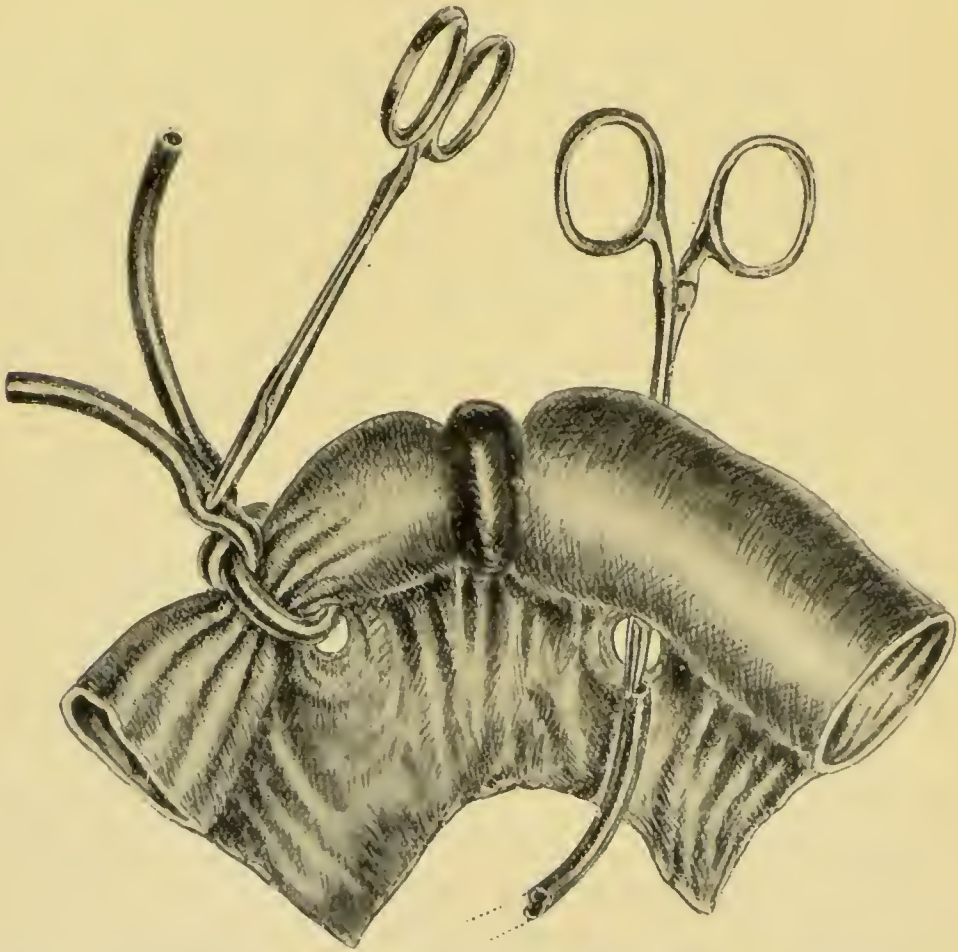


FIG. 5.—METHOD OF CLAMPING INTESTINE BY ELASTIC LIGATURES.
(L. MARK.)

very convenient method, and is very efficacious. I do not like it so much as the method before described.

One word as to the application of clamps. They should not be applied for a longer period than is necessary; they should not, therefore, be applied until the bowel is about to be opened. The first row of sutures should

be inserted before the application, and in Halsted's method the whole of the sutures are inserted before it is necessary to use a clamp. Secondly, they should be applied at some distance from the part to be sutured, at least 2 inches away. There are two reasons for this—(1) that the vessels close to the anastomoses should not be damaged by the clamp, and (2) that the walls of the gut should not be dragged out of position by the clamp.

Thirdly, they should be taken off as soon as possible, and in cases where the anastomosis is effected by a

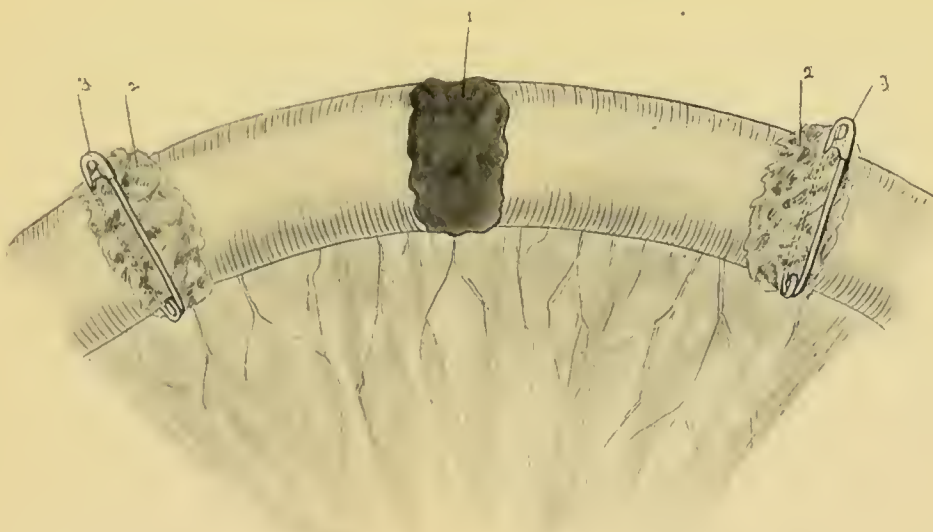


FIG. 6.—MAUNSELL'S SPONGE AND SAFETY-PIN CLAMP.

1, Stricture of intestine ; 2, sponge ; 3, safety-pin passed through mesentery.

double row of sutures the clamp may usually be removed with safety when the first row has been completed. Lastly, there is no clamp so good as an assistant's fingers ; but if the operation is prolonged this is apt to be trying for him. In Halsted's anastomosis I do not think a clamp is necessary, since the sutures are all passed before the bowel is opened, and as the anastomosis is

done outside the abdominal cavity, any slight escape of intestinal contents can be wiped up, and there is no fear of any finding its way into the peritoneal cavity.

SECTION III

THE VARIETIES OF SUTURE

I. **Interrupted.**—1. The best-known suture is the Lembert suture, which aims at picking up the peritoneal and fibrous coats alone (*vide* Fig. 7). The essential part

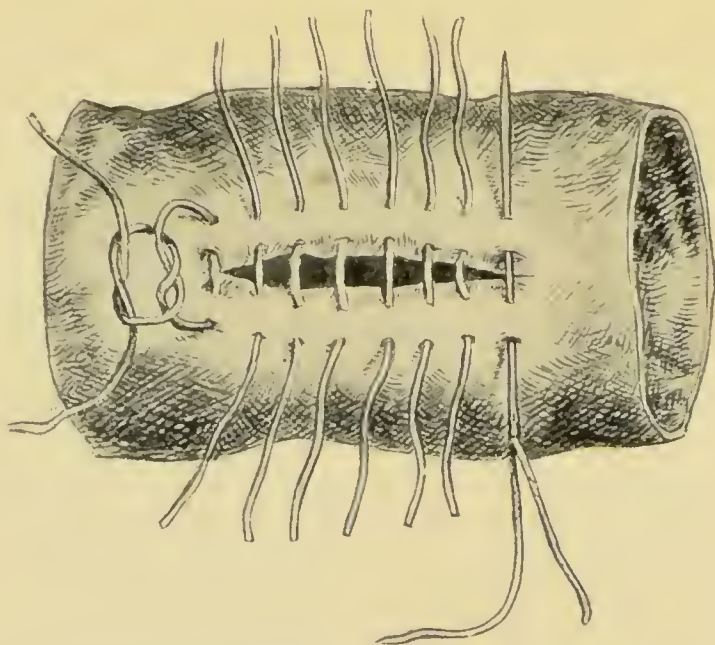


FIG. 7.—LEMBERT'S SUTURE. (L. MARK.)

of the stitch is that the needle is inserted about $\frac{1}{8}$ inch from the cut edge, and brought out at $\frac{1}{16}$ inch from the edge, so as to produce some inversion of the edge of the gut and insure the apposition of the peritoneal surfaces. It is not, however, a very strong stitch, and is very liable to cut out; this can easily be verified by pulling on it.

2. The Czerny stitch is one which is passed through the mucous membrane alone, and the knot is tied on the in-

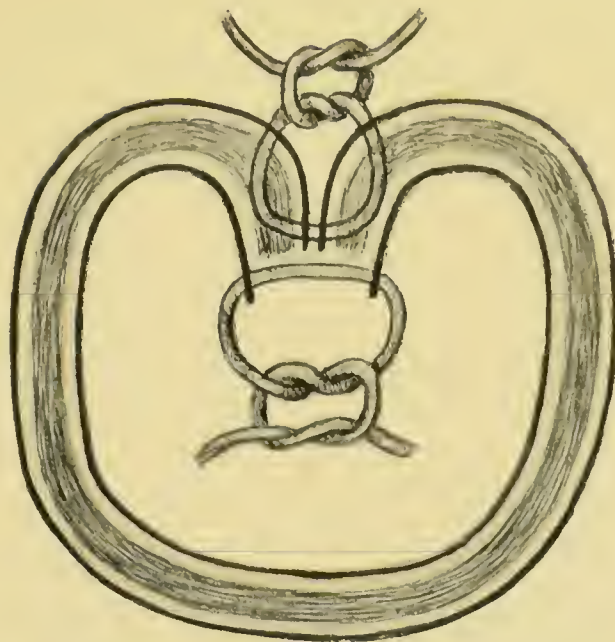


FIG. 8.—CZERNY-LEMBERT SUTURE. (L. MARK.)

The Czerny stitch is the lower one, passing through the mucous membrane alone. Above this is an ordinary Lembert stitch.

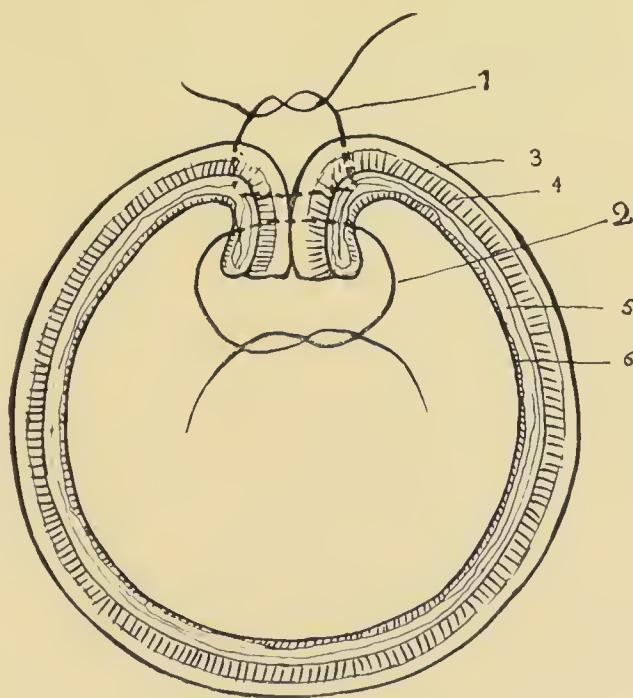


FIG. 9.—WÖLFER'S SUTURE.

1, Lembert's suture passed through serous, muscular, and submucous coats; 2, modified Czerny suture passed through all the coats, and tied inside the bowel; 3, serous coat; 4, muscular coat; 5, submucous coat; 6, mucous membrane.

side of this coat ; this stitch is shown in Fig. 8, and is only used in combination with Lembert's stitches.

3. In Wölfer's method, the first row of stitches passes through all the coats of the bowel, and the knots are tied inside as far as possible ; at any rate, each stitch is passed from mucous membrane to serous of one edge, and from serous membrane to mucous of the other edge. The method is completed by a row of Lembert's sutures. This is an excellent method, and gives a strong support.

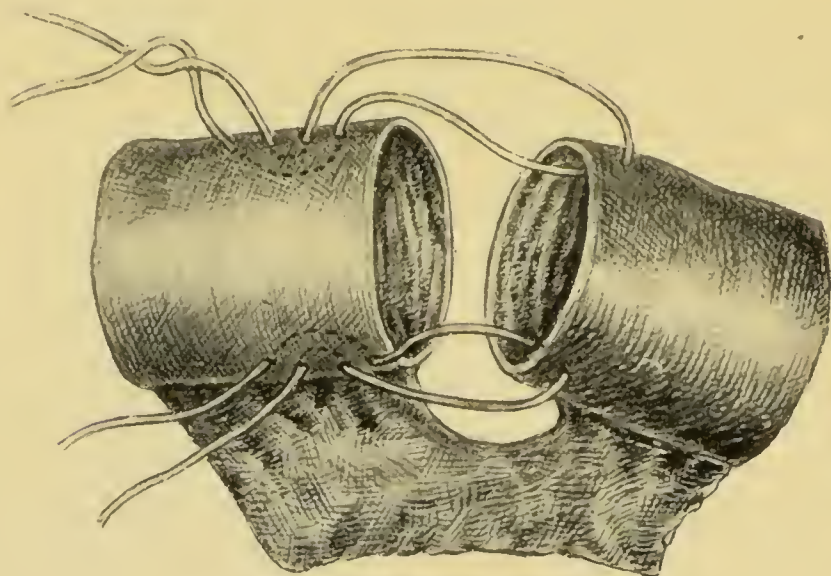


FIG. 10.—JOUBERT'S METHOD. (L. MARK.)

4. Joubert's stitch, as shown in Fig. 10, aims at producing an invagination of one portion of the intestine into the other, but it cannot be recommended, since it is passed through all the coats of the bowel and has its knot outside. Infection is therefore probable.

5. **Halsted's Method.**—In this method each stitch is made to pick up some of the fibres of the submucous coat, since this coat possesses the most tough fibrous tissue of all the others. It is easy to distinguish the resistance of this coat by passing a needle with steady pressure verti-

cally into the gut, when it will be found that a considerable steady pressure is needed before the gut is perforated ; of course, a jerk will perforate it at once. If the needle is pressed steadily towards the lumen, and when the resistance is felt it be lateralized, and pushed on so as to emerge from the serous coat again, the point will pick up some fibres of the submucous coat. Halsted employs a double stitch, called a mattress suture, so as to bring a larger amount of serous surface in apposition. The

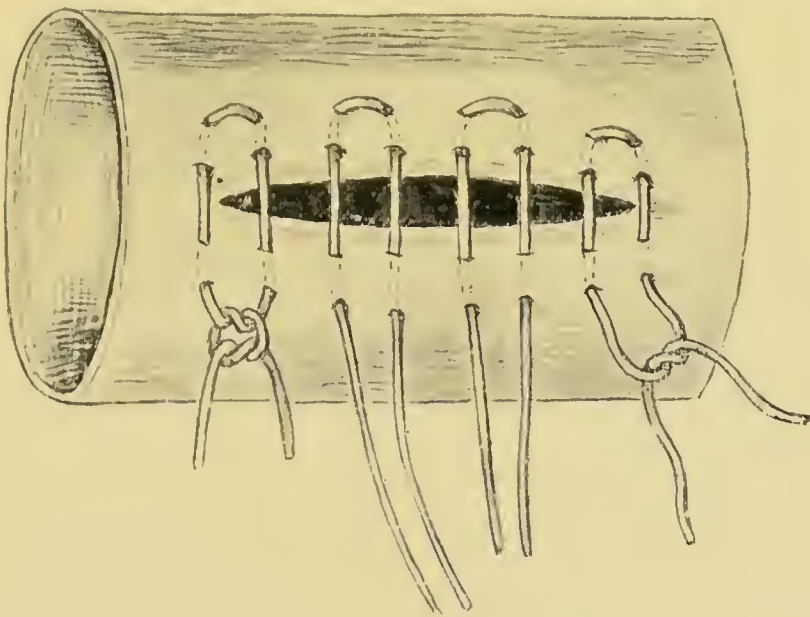


FIG. 11.—HALSTED'S MATTRESS SUTURE. (L. MARK.)

needle is made to enter $\frac{1}{8}$ inch and to come out at $\frac{1}{16}$ inch from the edge, then to enter $\frac{1}{16}$ inch from and to emerge $\frac{1}{8}$ inch from the opposite edge ; it is then reinserted $\frac{1}{8}$ inch away from the point of exit, and passed in the same way through both edges. Each stitch should be $\frac{1}{8}$ inch apart, and the row should be parallel and equidistant (see Fig. 11). In order to insure this, it is best to pass the whole row of sutures and clamp their ends before tying any. This stitch is the ideal one, since it does not perforate the mucous membrane, and yet it is absolutely strong, and

no extravasation can take place. It is the one which I employ on practically all occasions.

II. **Continuous.**—These can be classified according to the coats of the bowel which are included in them, or according to their shape.

1. The simplest form is the continuous Lembert, or Dupuytren's suture, which is used in most cases where two rows of sutures are inserted. It is inserted in the same way as the simple Lembert, and care should be taken that the needle is made to enter points in each edge opposite to each other. Fig. 12 shows this suture. The suture is commenced by passing an ordinary Lembert stitch, which

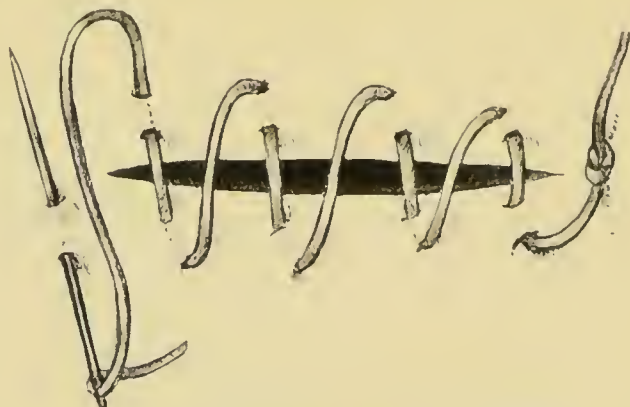


FIG. 12.—CONTINUOUS LEBERT OR DUPUYTREN. (L. MARK.)

is tied; the end of the silk to which the needle is attached is then used for the continuous suture; it is finished off by tying it to one of the ends of an ordinary Lembert suture which has been inserted just beyond the termination of the continuous suture, or it may be finished off by not pulling the short end of the silk through the last stitch-holes, and then tying this short end to the loop on which the needle is threaded. It is essential, in passing the continuous suture, (1) to pull each stitch tight after passing it, and, (2) in order to prevent undue puckering when putting in the stitch, to oversee the suture every third or fourth stitch; this is shown in Fig. 13.

2. The continuous suture used for uniting the whole thickness of the gut is called a Glover's stitch, or ordinary top sewing. This is used in practically all anastomoses by continuous sutures (*vide* Fig. 13).

3. Cushing's is explained by Fig. 14. After passing and

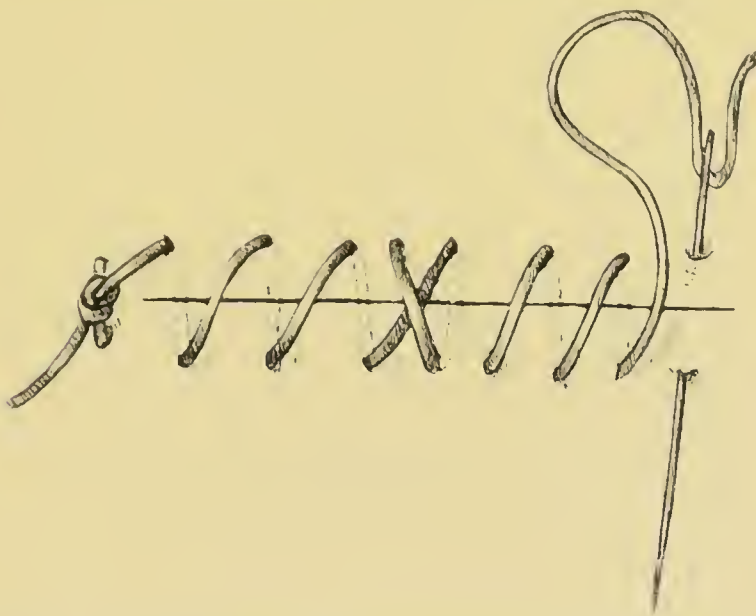


FIG. 13.—CONTINUOUS GLOVER'S STITCH. (L. MARK.)

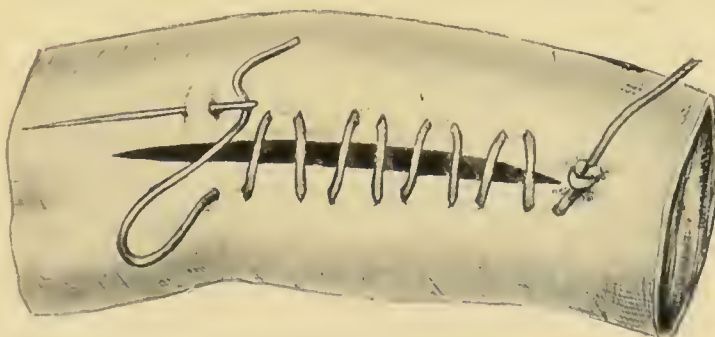


FIG. 14.—CONTINUOUS CUSHING SUTURE. (L. MARK.)

tying an ordinary Lembert's stitch, the suture is continued by inserting the needle parallel to the incision in the gut and about $\frac{1}{8}$ inch from its edge. A portion of the serous and muscular coats are then picked up, and the needle is inserted in a similar direction on the opposite edge of the incision, just below the former stitch; this is continued to

the end of the wound, and it is finished off by uniting its free end to one end of a Lembert's suture, which is passed and tied beyond the end of the wound.

4. I frequently employ a continuous suture passed in the same way as a Halsted's stitch. After passing and tying an ordinary Halsted's mattress suture, another is passed just beyond it with the same silk; this is then continued backwards and forwards across the wound to

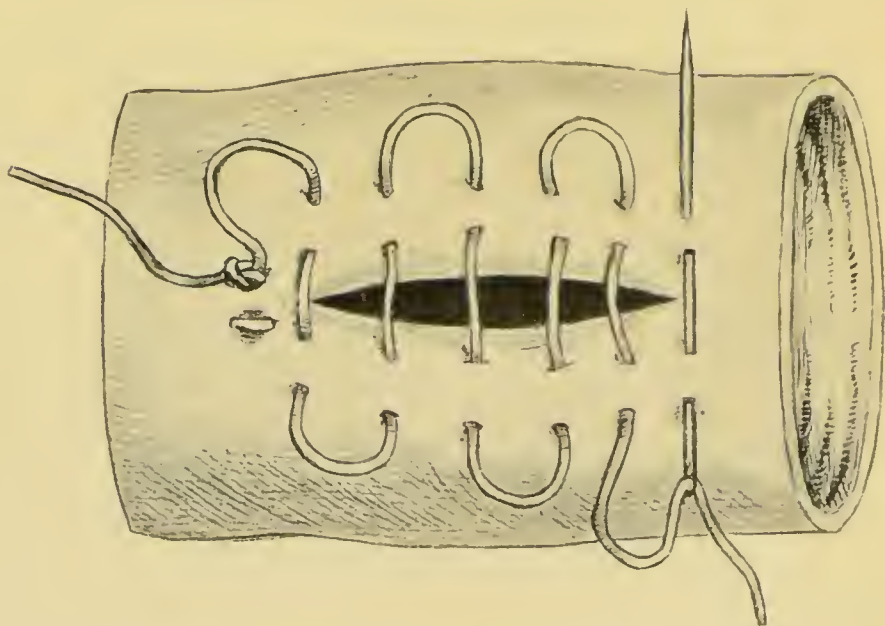


FIG. 15.—CONTINUOUS MATTRESS STITCH. (L. MARK.)

its end, each thread being $\frac{1}{8}$ inch apart; it is finished off by uniting the free end to another Halsted's stitch, which is passed and tied beyond the end of the wound. This makes a very firm suture, and does not produce much puckering. It is shown in Fig. 15.

5. Gely's suture is also a secure one, and is recommended for closing an incised wound of the gut. It is used with two needles, which are inserted one at each side, parallel to, and about $\frac{1}{8}$ inch from, the edge of the wound. The needles are then crossed and inserted below in a

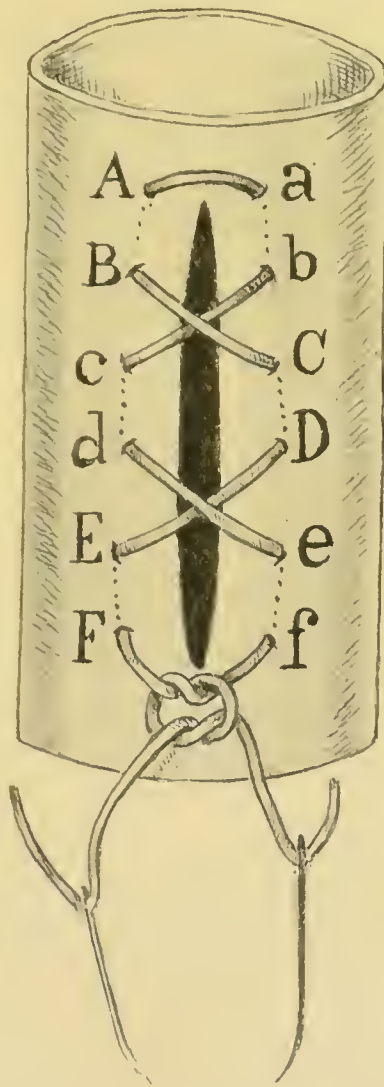


FIG. 16.—GELY'S STITCH. (L. MARK.)

The large letters represent the stitches made with one needle, and the small letters represent those made with the other needle.

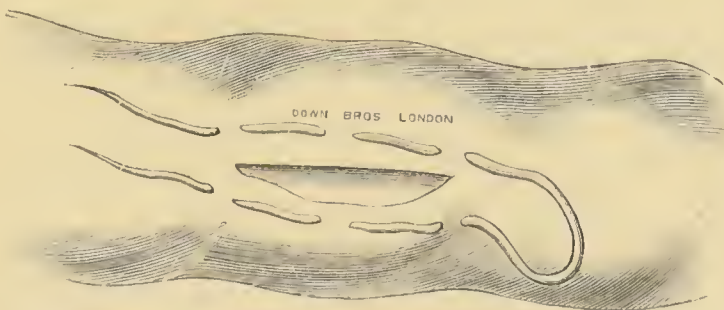


FIG. 17.—PURSE-STRING SUTURE. (DOWN BROS)

The suture is passed through all the coats in two parallel lines before the gut is opened.

similar way. The method resembles lacing up a boot ; this is shown in Fig. 16.

6. The only other continuous suture which we need mention is the purse-string suture, where the needle is passed in and out through the whole thickness of the bowel, leaving a suture which will pull the coats of the bowel tightly round any object. This is used in the application of Murphy's button and in tying in a Paul's tube. It is shown in Fig. 17. Another form is shown in Fig. 24.

CHAPTER II

SECTION I

METHOD OF CLOSING AN INCISED WOUND IN THE BOWEL

THIS should always be done by a double row of sutures when possible, and a series of interrupted stitches is preferable to a continuous one, since the latter causes more contraction and puckering of the scar. The best method is to pass a row of interrupted stitches from within outwards through

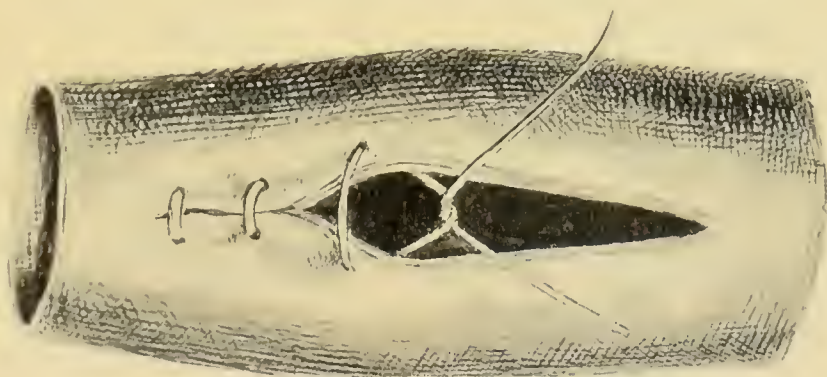


FIG. 18.—METHOD OF CLOSING A WOUND IN THE BOWEL.
(L. MARK.)

These stitches are commenced at the mucous membrane, and when tied the knots will be inside.

all the coats of the bowel, and tie them with their knots inside. Each stitch is passed from the mucous surface, and finishes at the mucous surface at the opposite side; it is quite easy to get the knots of all the earlier stitches inside the bowel, and the knot of the last stitch can be tucked in with a probe. The union is completed by a row

of Halsted's or Lembert's stitches passed in the way directed in the last chapter. One point to be remembered

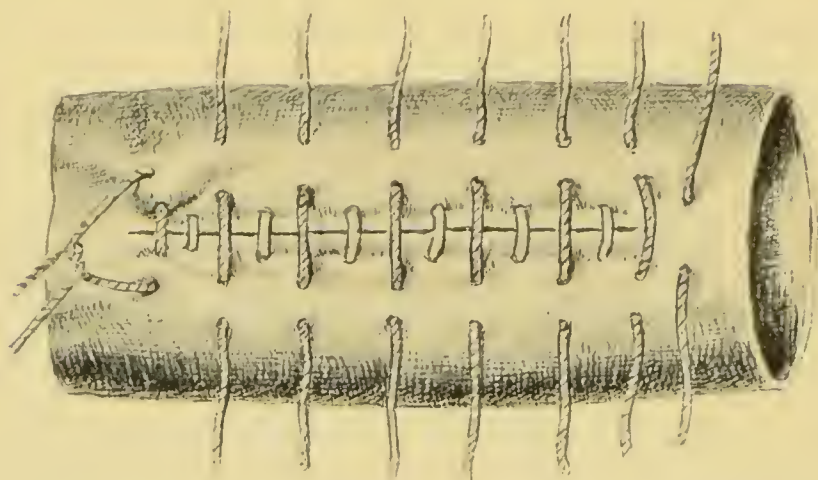


FIG. 19.—CLOSING WOUND IN BOWEL. (L. MARK.)

The first row of sutures have been tied with their knots inside. The row of Lembert's have been passed, but have not been tied.

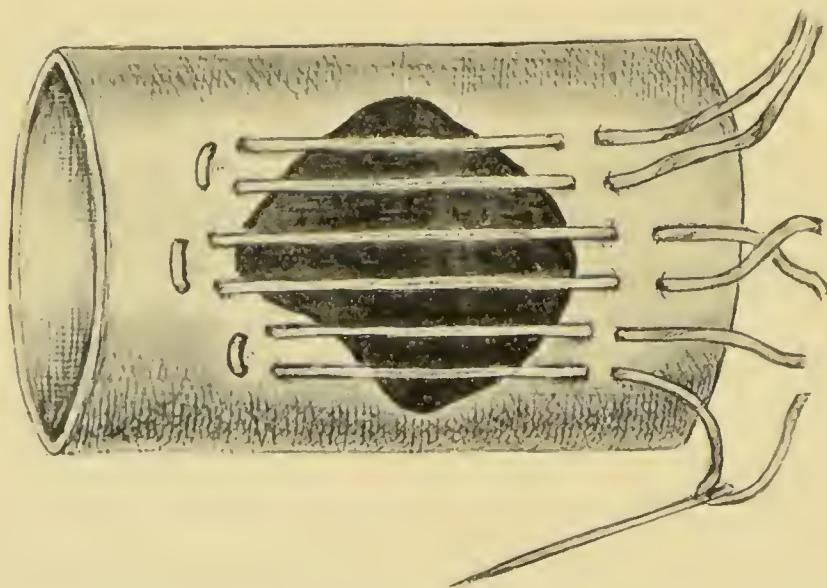


FIG. 20.—METHOD OF CLOSING WOUND WITH LOSS OF SUBSTANCE. (L. MARK.)

Three Halstead's sutures have been passed.

is that the first and last peritoneal stitches must be passed beyond the limits of the incision. Fig. 19 shows this.

Instead of the Lembert's or Halsted's sutures, a continuous mattress or Gely's suture may be employed.

If the wound has involved loss of substance of the circumference of the bowel, this method might lead to severe contraction. In such a case, it is advisable to suture the wound transversely to its axis ; this is done by passing the first stitch so as to bring the ends of the

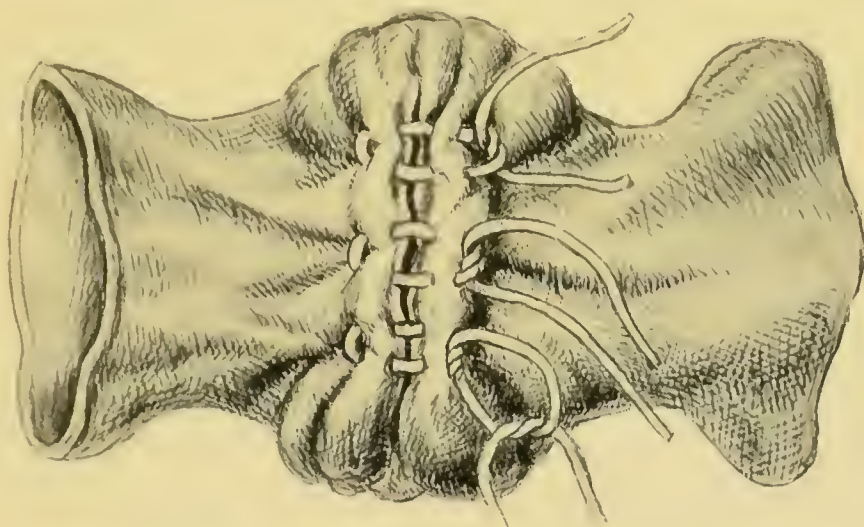


FIG. 21.—THE APPEARANCE WHEN THE SUTURES ARE TIED. (L. MARK.)

wound together in the centre, as shown in Figs. 20 and 21. After the incision has been closed with sutures on each side, the operation is completed by a row of Halsted's sutures, and the result is a transverse scar instead of a vertical one.

SECTION II

THE CHOICE BETWEEN A LATERAL AND AN END-TO-END ANASTOMOSIS

The following are the advantages of a lateral anastomosis :

1. The union is made at the convex borders of the bowel, where the peritoneal covering is complete, and so is placed in the best position for strong and early adhesions.

3. As the incision of the bowel is made at some distance from the mesentery, the bleeding is slight, and practically no ligatures are required to stop hæmorrhage.

3. It is easy to perform, especially if Halsted's method be employed, since in this case the sutures are introduced before the bowel collapses.

4. The avoidance of the mesenteric border of the bowel in this anastomosis obviates any risk of extravasation.

5. The opening can be made of a considerable length, and, as it does not contract very much, there is little likelihood of stricture resulting.

The disadvantages are :

1. The intestinal contents may not go through the new opening. This difficulty can be obviated by occluding the bowel beyond the anastomosis, so as to divert the whole of the contents through the new opening ; this involves suture of two ends of bowel.

2. The length of time occupied in the performance of this triple operation is greater than in a simple end-to-end anastomosis.

3. The opening is not in the direct axis of the intestine, although it tends to become so after a time.

4. No special apparatus can be profitably used in lateral anastomoses, since either a bobbin or a button seems to prevent any passage through the opening so long as it remains in position.

5. Rather more bowel is cut off from the general circuit.

On the other hand, the advantages of end-to-end anastomoses are :

1. The two pieces of intestine are united in a direct line.

2. It is the most economical of bowel.

3. Buttons and bobbins can be employed when time is of extreme importance.

4. It takes less time than a lateral operation combined with closure of the ends of the gut.

The disadvantages are :

1. It is more difficult to perform.
2. It is very difficult to insure the apposition of the portions of the gut between the layers of the mesentery.
3. The stitches at the mesenteric border may interfere with the nutrition of the rest of the line of union.
4. There is a great liability to cicatricial contraction producing a stricture.

I am therefore disposed to recommend the lateral anastomosis wherever it is practicable, especially for surgeons who have not had much experience of intestinal work. I am sure that the surgeon will have much less anxiety, and the patient's chances of recovery will be much greater.

SECTION III

I strongly recommend that the various methods of performing anastomoses by suture alone be practised before attempting those which involve the use of any apparatus, since a thorough knowledge and experience of the methods by simple suture is desirable before using an apparatus.

Lateral Anastomosis by Suture Alone

General Directions.—I have already referred to the importance of uniting together movable portions of bowel, but there is another point of equal importance to bear in mind, and that is to insure that the direction of the peristaltic waves should be the same in the afferent and efferent portions of the gut. It is therefore necessary to give the loop of gut a half-turn before uniting the two portions, so as to insure that the intestinal contents will

go in the right direction after passing through the new opening. Figs. 22 and 23 will explain this. The next point is that the anastomosis should be made at some distance from the end of the bowel or from the seat

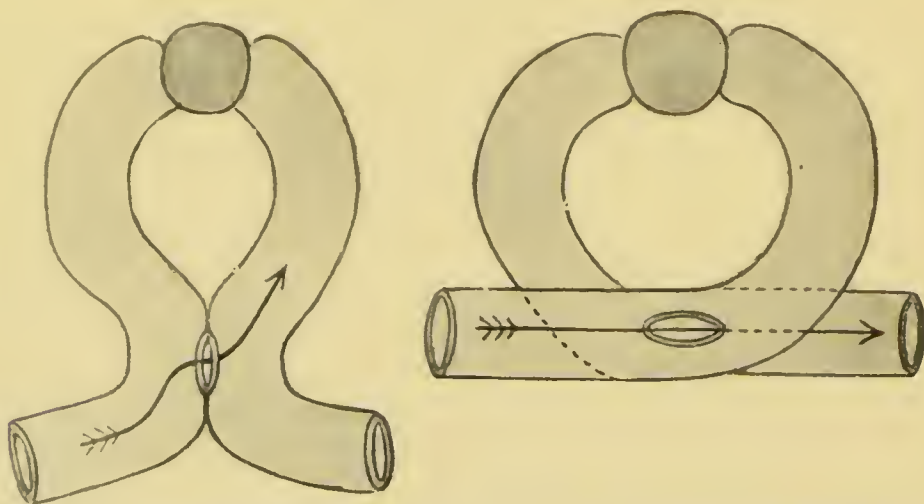


FIG. 22.—THE METHOD OF APPLYING TWO PIECES OF BOWEL IN SHORT-CIRCUITING. (L. MARK.)

The left-hand diagram shows the wrong way and the right-hand figure the right way to make a lateral anastomosis. The arrows show the direction of the waves of peristaltic contraction.

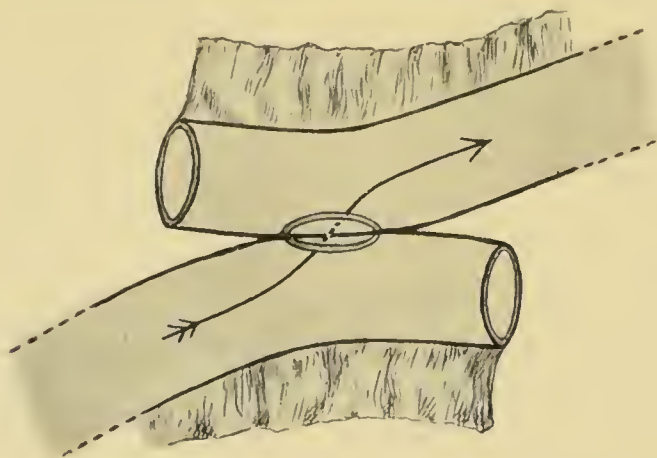


FIG. 23.—THE METHOD OF APPLYING TWO PIECES OF BOWEL TO EACH OTHER AFTER ENTERECTOMY. (L. MARK.)

of obstruction. It is better to allow at least 2 inches between the end of the anastomosis and the point at which the gut will be divided; this makes no difference to the patient, as the portion of gut beyond the anasto-

mosis atrophies at once. The longer distance, however, makes the operation of occluding the ends easier.

The management of the mesentery in lateral anastomosis does not present any difficulty, since it is not near the line of union. If the operation is simply a short-circuiting one and not accompanied by occlusion, the mesentery will not be touched, but if it be performed in the course of a resection of the bowel, the mesentery should

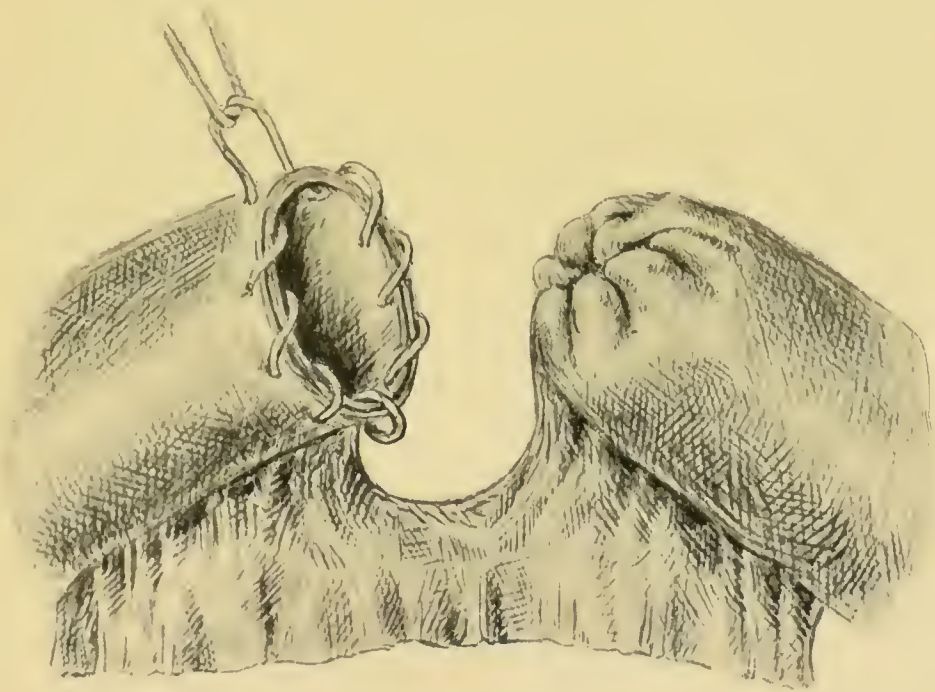


FIG. 24.—OCCLUSION OF INTESTINE. (L. MARK.)

On one side the purse-string suture has been passed, and on the other it has been tied, puckering up the end.

be ligatured close to the portion of bowel removed ; and when the anastomosis is complete, the parts of the mesentery which lie over one another should be united with a few points of suture.

In cases where occlusion is necessary after lateral anastomosis, the bowel is divided between clamps about 3 inches from the anastomosis, and each end is closed. This may be done by two rows of sutures as directed for

closing a wound of the gut, but a simpler and quicker way is to insert a purse-string suture, passing through all the coats right round the gut close to its cut end, being careful to pick up the peritoneum on each side of the mesentery ; this is tied tightly, puckering up the end of the gut, as is shown in Fig. 24. The purse-string suture also has the effect of stopping all hæmorrhage, and the clamp may with advantage be removed after this is applied. About three Halsted's sutures will then completely invaginate

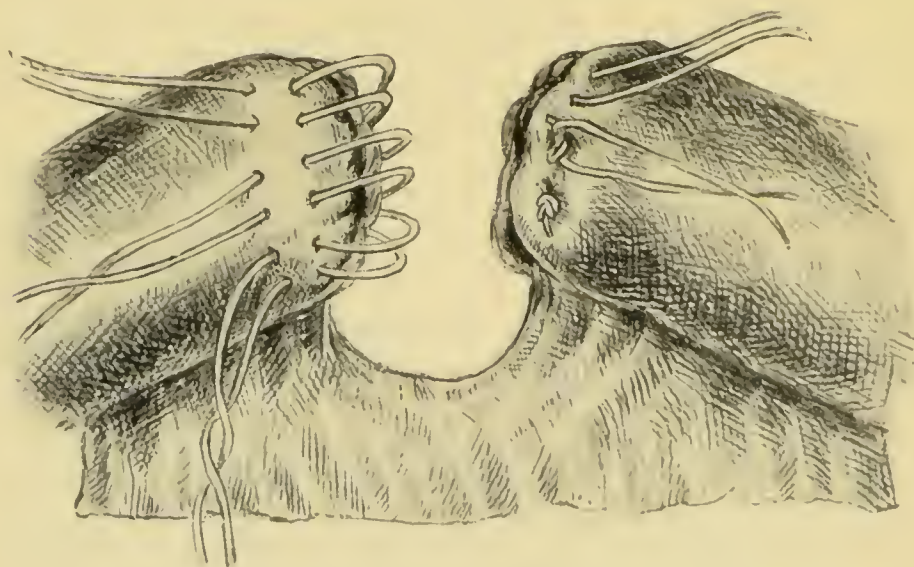


FIG. 25.—OCCLUSION OF INTESTINE. (L. MARK.)

On the one side the invaginating stitches have been passed but not tied ; the other side shows the occlusion complete. Note the stitch nearest the mesentery has been tied first.

this stump of gut and complete the occlusion. It is important to pass these invagination stitches about $\frac{1}{2}$ inch from the end of the gut, and the first one should be close to the mesentery ; this one must be tied before the others. This is shown in Figs. 25 and 26.

Halsted's Method.—The great advantage of this method is that all the stitches are passed before the gut is opened, and this minimizes the risk of fæcal extravasation ; it also facilitates the passage of the sutures. The

disadvantage is that the union is effected by a single row of stitches, and that theoretically infection of the bowel coats may take place. In my experience, however, it has proved absolutely trustworthy, and though, of course, I sometimes lose cases after intestinal operations, in no case of operation by this method has death resulted from extravasation through failure of the line of union.

The operation is performed as follows :

Two dozen straight needles should previously be threaded with fine silk, and be within reach of the surgeon's hand.

The two pieces of gut between which it is desired to make

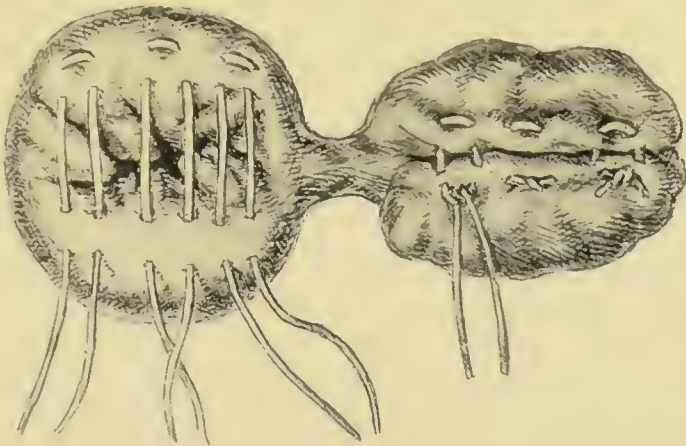


FIG. 26.—OCCLUSION OF INTESTINE. (L. MARK.)

The passage of the invaginating stitches seen from above.

an anastomosis are then brought outside the abdomen and placed against each other, care being taken that the direction of the peristaltic contractions should be the same in each portion of gut as pointed out above. Six square or quilt sutures are inserted in a straight line midway between the mesenteric borders of the knuckles of intestine ; the two threads of each stitch should be $\frac{1}{8}$ inch apart. These are all passed before any are tied, so as to insure the line being straight ; they are then tied and the

ends cut short. At each end of this (which is the posterior row of sutures), and nearer the convex border of the intestine, two lateral square stitches are inserted; they

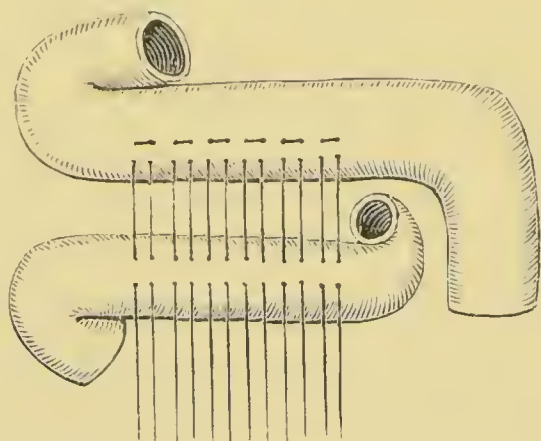


FIG. 27.—HALSTED'S METHOD. (JESSETT.)

The passage of the posterior row of sutures.

are passed by inserting the needle at an angle of 45 degrees with the posterior row. These stitches are tied and the ends cut short. A gutter will now be formed. The

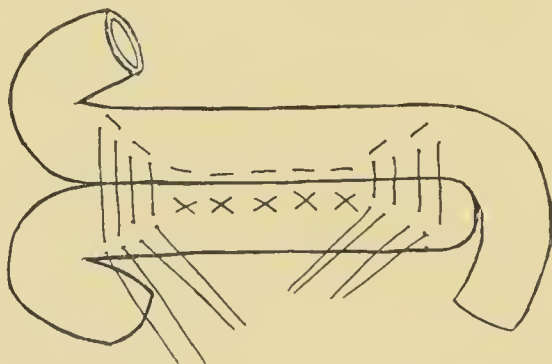


FIG. 28.—HALSTED'S METHOD, SECOND STAGE.

The corner stitches have been passed at an angle of 45° to the posterior row.

method of passing these is shown in Fig. 28. The knots of all these stitches will be inside the anastomosis.

The anterior row of sutures must now be passed, and the first one at each end must extend beyond the lateral

sutures, so as to completely bury the knots. These two end stitches should be passed first, and if they be held up it will be easy to pass the rest of the row in a straight line between them. The stitches in this row are not tied, but their ends are clamped with Spencer Wells forceps ; about nine to twelve will have to be passed, as the anterior row is much longer than the posterior. Clamps are now applied on each side of the anastomosis, and two blunt hooks are introduced in the middle of the row of sutures, and the threads are drawn aside so as to expose the two portions

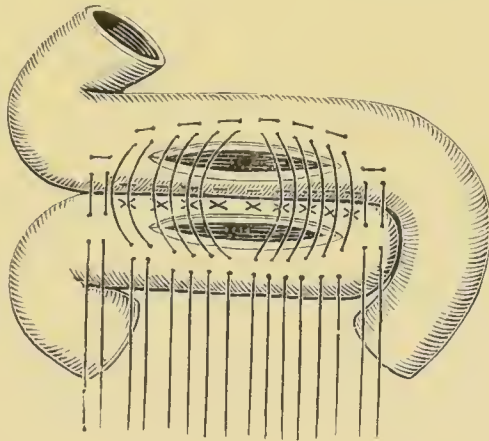


FIG. 29.—HALSTED'S METHOD. (JESSETT.)

All the sutures have been passed, and those of the posterior row have been drawn aside to permit the openings to be made.

of intestine included within the sutured area. An opening is now made in each piece of gut with a scalpel, and enlarged to the whole length of the line of stitches with scissors. This is shown in Fig. 29. The bleeding will be very slight, and probably no point will require ligature, since any oozing will stop when the sutures are tightened. The opening should be made in the collapsed portion of gut first, so as to lessen the danger of extravasation. When both openings have been made and bleeding-points ligatured, the blunt hooks are removed and the sutures tightened by pulling on the forceps ; the stitches are then

tied under a stream of normal saline solution. When all are tied, the ends are cut off, and the anastomosis is complete.

Lateral Anastomosis by Continuous Sutures.

This is a slightly more rapid method in expert hands, but requires great care in pulling each thread taut when passing the sutures, and is also apt to lead to some contraction of the opening.

The two loops of the intestine are placed in position, as in Halsted's operation, and a continuous suture (either Dupuytren's or mattress), uniting the peritoneal and

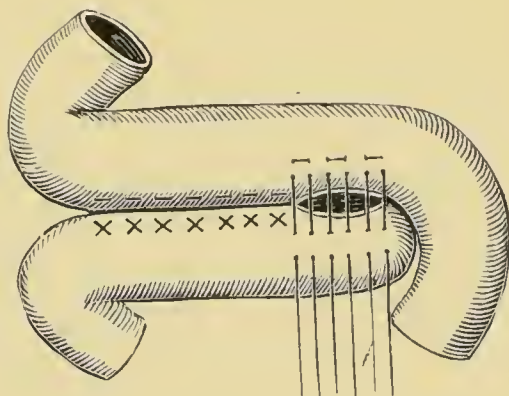


FIG. 30.—HALSTED'S METHOD, FINAL STAGE. (JESSETT.)

All but the last three sutures have been tied.

muscular coats, is applied with a curved intestinal needle midway between the mesenteric and convex borders. At its commencement it is tied and the short end clamped; it should unite the two pieces of intestine for about 2 inches, and it is necessary to oversee at every fourth stitch, so as to avoid puckering of the line of suture or any loosening of the individual stitches. This is shown in Fig. 31.

The needle and silk are then clamped with a pair of Spencer Wells forceps.

Clamps are now applied to the bowel on each side of the

anastomosis, and an incision about $1\frac{3}{4}$ inches long is made in each loop of intestine about $\frac{1}{4}$ inch from the line of the continuous suture. Another curved needle armed with a long silk suture is then taken, and the opposite edges of the two openings are united by a continuous suture passing through all the coats; in each stitch, however, the needle must be passed from the mucous surface of one edge through the serous, and made to enter the serous surface of the other edge, coming out at the mucous. Although

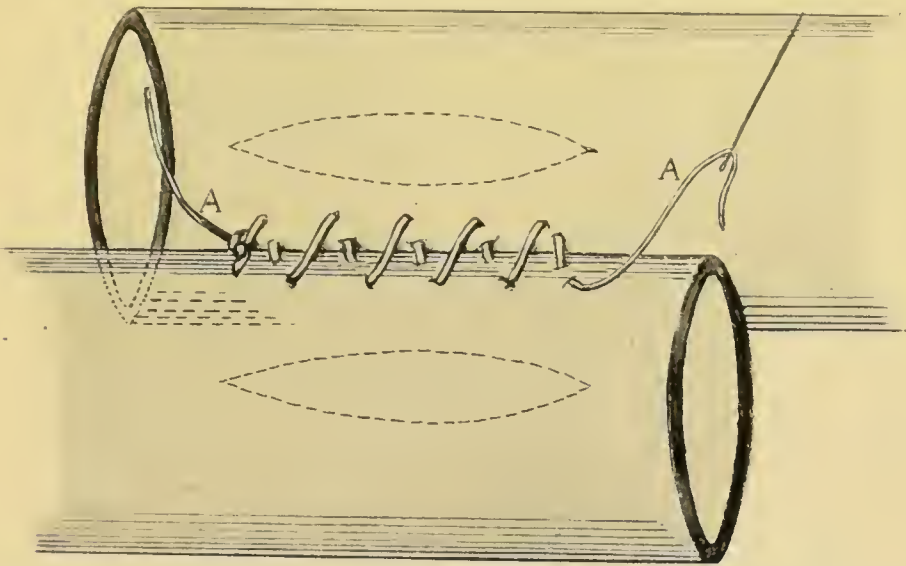


FIG. 31.—LATERAL ANASTOMOSIS BY DOUBLE CONTINUOUS SUTURES.
A, Posterior continuous Lembert suture.

the posterior edges of the incision are united first, it is more convenient to start the suture just on the anterior side of the angle of the incision, as it is difficult to close up the corner properly at the end. The suture is tied at its commencement and its short end clamped; this is shown in Fig. 32.

In passing this suture, care must be taken not to include the peritoneal stitch in it, and the suture must be oversewn at every fourth stitch. When the union of the posterior edges is completed, the anterior edges are united

in the same way, care being taken to commence each stitch from the mucous surface, so as to invert the cut

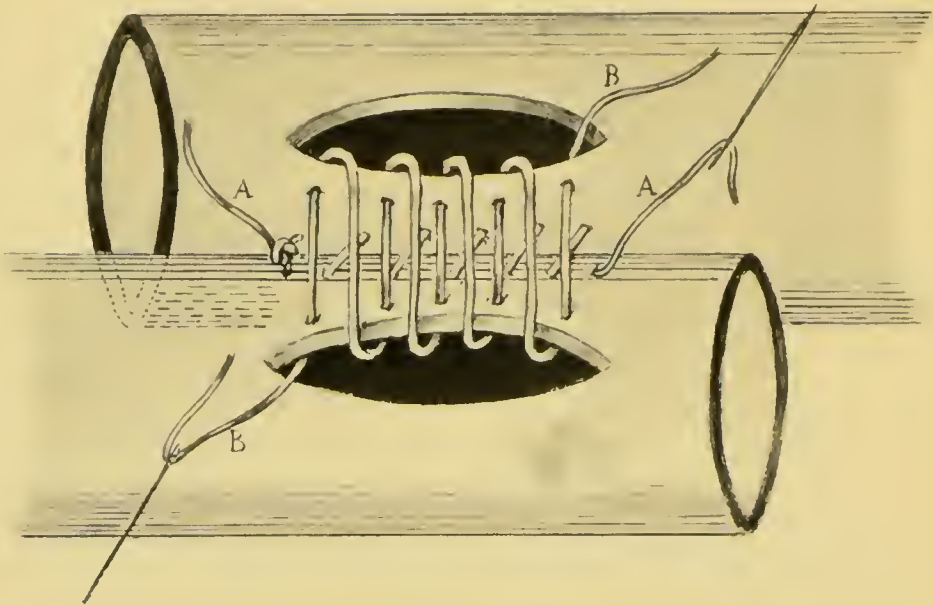


FIG. 32.—LATERAL ANASTOMOSIS BY DOUBLE CONTINUOUS SUTURES. The openings have been made, and the posterior part of both sutures have been passed.

A, Continuous Lembert ; B, continuous suture passing through all coats, which has not been tightened for the sake of clearness.

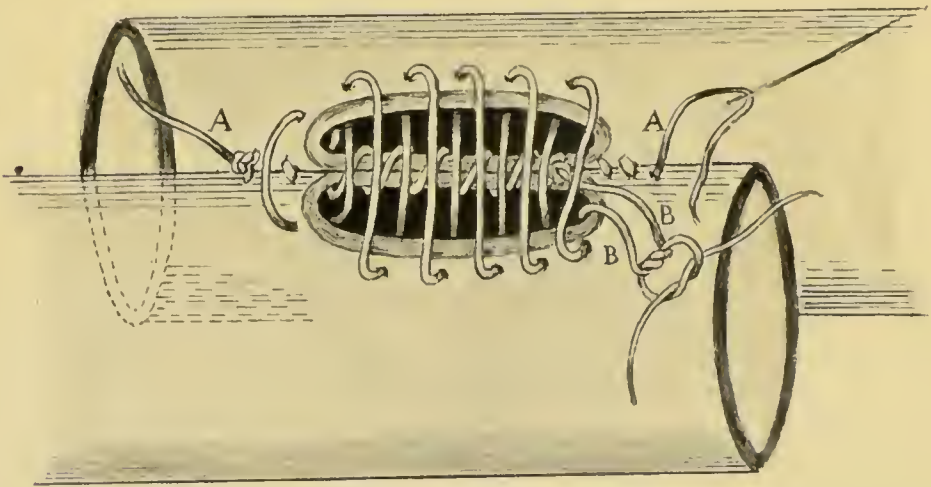


FIG. 33.—LATERAL ANASTOMOSIS BY DOUBLE CONTINUOUS SUTURES. The suture passing through all coats, B has been carried completely round the opening, but has not been drawn tight.

edge. When the whole circumference of the new opening is sewn up, the suture is tied to the short end, left at its

commencement, and both ends are cut short and the knot tucked inside the mucous membrane. The clamps can now be removed from above and below the anastomosis, and the continuous peritoneal suture which had already united the posterior part is carried around the anterior surface of the anastomosis about $\frac{1}{4}$ inch outside the suture, involving all the coats of the bowel. The end of this suture is then tied to the short end left at the commencement of the peritoneal suture. The anastomosis is now complete.

CHAPTER III

END-TO-END ANASTOMOSIS

THE first consideration is the management of the mesentery. There are two ways of treating this: (1) A **V**-shaped piece is cut away corresponding to the knuckle of intestine removed, the vessels being tied as divided, and the sides of the **V** being brought together

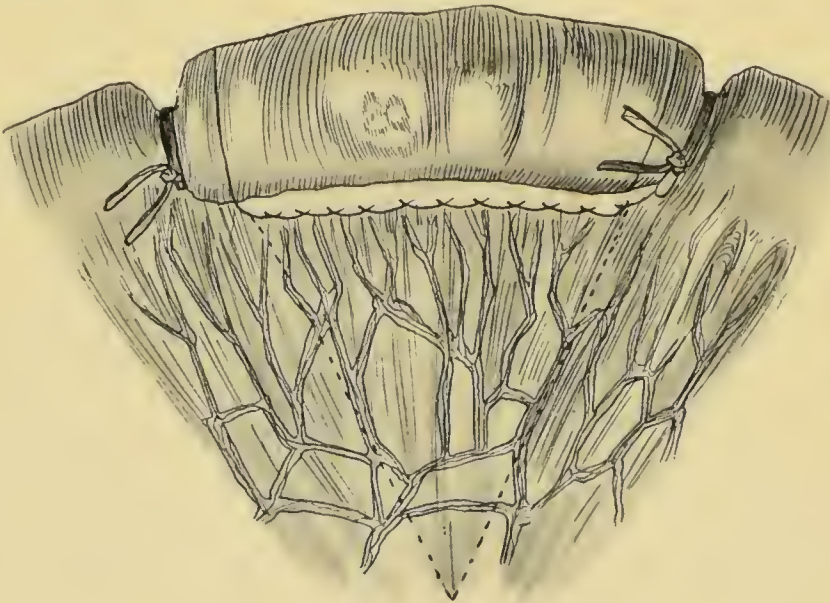


FIG. 34.—MANAGEMENT OF THE MESENTERY. (AFTER CHEYNE.)

The dotted line shows the incision when a V-shaped portion is removed. In the figure the mesentery has been divided and ligatured close to the bowel.

after the anastomosis. This is open to the objection that it entails some interference with the blood-supply of the two ends of the gut, and, moreover, it may be difficult to pick up a bleeding-point at the bottom of the **V** close

to the root of the mesentery. It is used only in cases of cancer or of gangrene. The second method consists in dividing the mesentery close to and parallel to the loop to be removed, and tying the bleeding-points. When the anastomosis is complete this will leave a redundant fold of mesentery, which must be sewn down upon itself with a continuous suture, so as to avoid leaving a hole through which a loop of gut might pass and become strangulated.

The second consideration is to avoid cicatricial con-

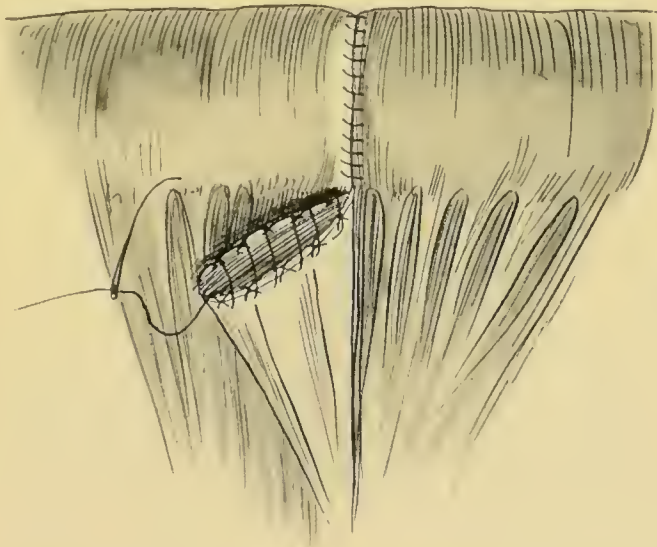


FIG. 35.—MANAGEMENT OF THE MESENTERY. (AFTER CHEYNE.)

The edge of the redundant portion of the mesentery has been closed with a continuous suture, and is then to be sewn down to the mesentery beneath it.

traction of the new opening. This is minimized by dividing the gut obliquely so as to remove about $\frac{1}{2}$ inch more of the convex than of the mesenteric border; this, of course, leaves a much wider line to be sutured, and so lessens contraction. It, moreover, has the advantage of removing the portion of the intestinal circumference which is furthest removed from the blood-supply, and so would be most likely to slough (see Fig. 36).

The last consideration is that the mesenteric borders of the two portions of intestine must be most accurately brought in apposition, as the absence of peritoneal covering for about $\frac{1}{4}$ to $\frac{1}{2}$ inch of the circumference of the gut at this point makes it difficult to insure a firm union.

The anastomosis may be effected by

1. A single layer of interrupted sutures.
2. Two layers of interrupted sutures.
3. Two layers of continuous sutures.

Under (1) we may use either a row of Lembert's

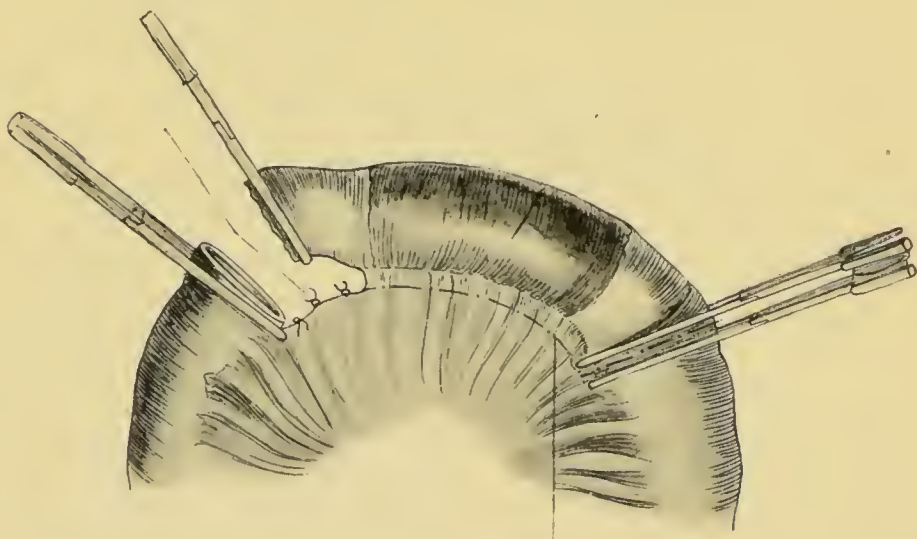


FIG. 36.—SHOWING THE OBLIQUE SECTION OF THE BOWEL IN CASES OF END-TO-END ANASTOMOSIS. (AFTER KOCKER.)

The mesentery is being divided close to the bowel.

sutures or one of Halsted's quilt sutures, but neither method is likely to be satisfactory, as it is difficult to pass the stitches so as to prevent any protrusion of the mucous membrane. The only single row of sutures which is satisfactory is the method recommended by Maunsell. In this method the sutures are passed through all the coats of the bowel, but all the knots are inside

the mucous membrane. As before mentioned, it does not much matter if the suture penetrates through all the coats of intestine if the knot is inside, since the suture tends to separate in the direction of its knot, and the danger of extravasation lies in the communication established after separation of the sutures rather than in any infection tracking along its thread. In order to pass and tie all sutures inside the bowel, a temporary intussusception is produced.

Maunsell's Method. — The mesenteric and convex borders of each piece of gut are united by two

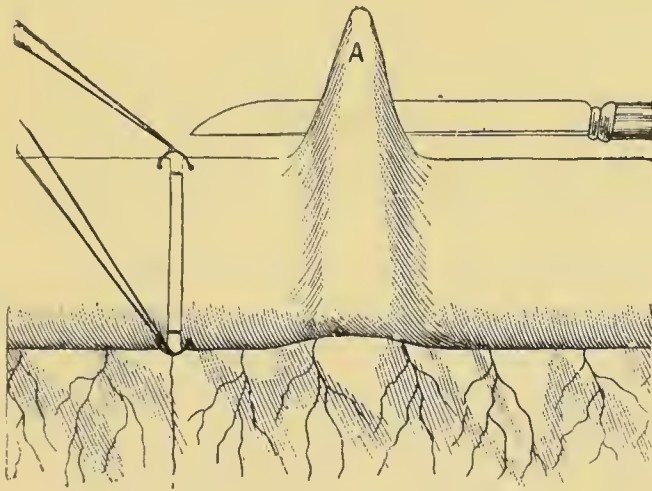


FIG. 37.—MAUNSELL'S METHOD. (MAUNSELL.)

The sutures uniting the mesenteric and convex borders should have been shown passed so that their knots were inside. The bowel is being opened below the anastomosis.

sutures passed through all the coats and with their knots inside the mucous membrane; they should be tied loosely, and their ends left long. A vertical incision is then made in the convex border of the lower segment of the bowel about $1\frac{1}{2}$ to 2 inches below its cut end, and of the same length as the diameter of the bowel at this point. A pair of clamp forceps are introduced through this incision, and the ends of the two guiding sutures are seized and brought through the

incision in the convex border. On pulling on these sutures, the two ends of the gut will be invaginated through the incision, and the upper portion will be inside the lower,

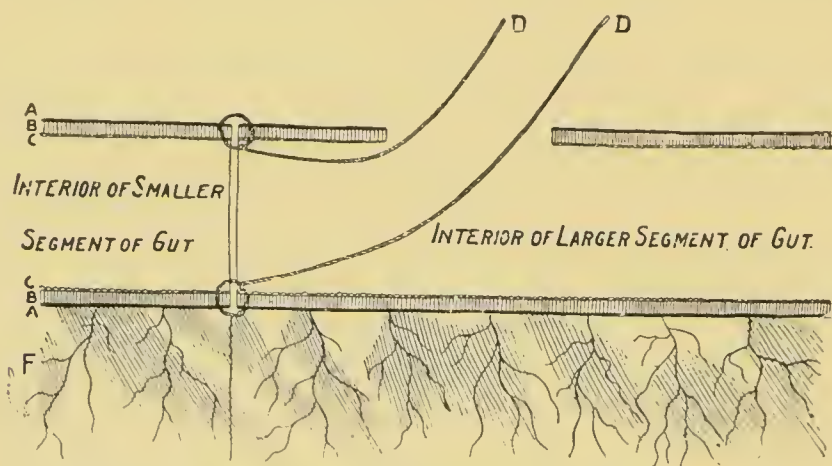


FIG. 38.—MAUNSELL'S METHOD. (MAUNSELL.)

The traction stitches have been brought out of the new opening.

the serous surfaces being in apposition. The opposite serous surfaces are clamped together in their centre, and a row of interrupted sutures about $\frac{1}{8}$ inch apart are

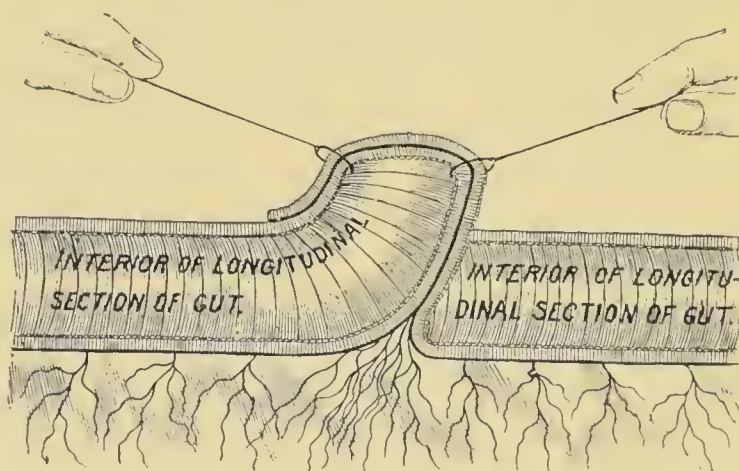


FIG. 39.—MAUNSELL'S METHOD. (MAUNSELL.)

The intussusception has been produced by pulling on and separating the traction stitches.

inserted all round the opening. Each suture is tied tightly, and its ends cut short. Care must be taken that the mucous membrane does not become everted

between the two ends. Maunsell recommends that the needle should be passed through both sides of the anastomosis—*i.e.*, through all the four thicknesses of gut—and the loop of silk picked up in the centre, thus passing two sutures in one. I do not, however, recommend this, as there is a risk of not picking up one of the walls of the intestine, and one cannot be so certain of preventing eversion of the mucous membrane. Moreover, the manœuvre is not easy with collapsed intestine.

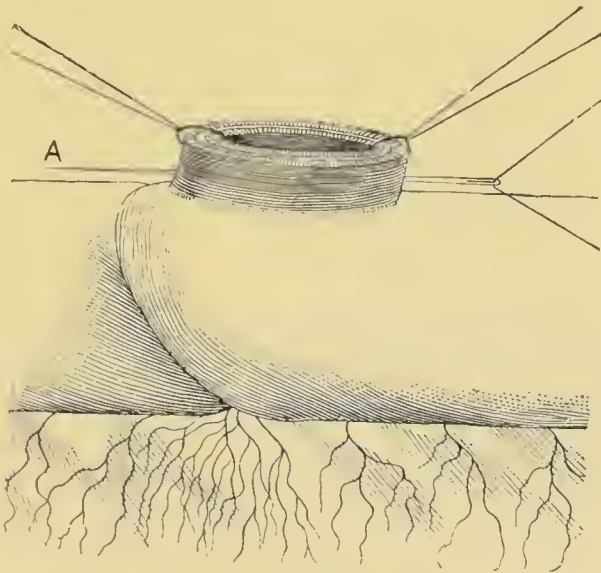


FIG. 40.—MAUNSELL'S METHOD. (MAUNSELL.)

The needle is being passed through both sides of both pieces of bowel.

After all the sutures have been passed and tied, the gut is pulled out straight, and the peritoneal surface of the line of sutures is examined carefully to see if the suturing is perfect. If any mucous membrane is seen, it is snipped off, and a Lembert suture is passed over the spot. In order to make the union more secure, I pass a row of Lembert's sutures all round the anastomosis, but this has the effect of producing some narrowing of the opening.

It now only remains to close the incision in the in-

testine below the anastomosis, which is done by a row of Lembert's sutures, or two or three Halsted's sutures. If time permits, before this is done the mucous membrane should be brought together with some interrupted stitches. This operation is performed very quickly, is very easy, and is followed by satisfactory results.

2. The method of anastomosis by two layers of interrupted sutures is a very good one, and is usually done by the Czerny-Lembert or Wölfer's method. In order to insure that corresponding portions of the circumference of the two pieces of intestine are united together, it is best to

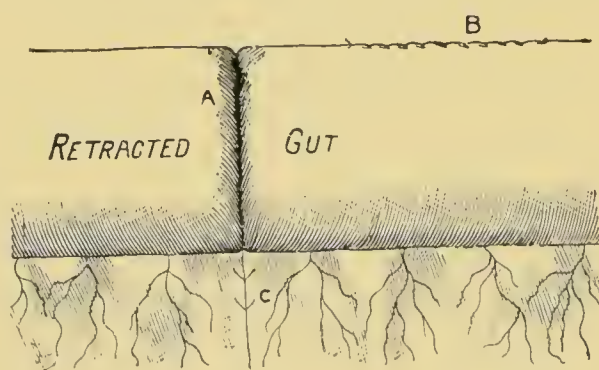


FIG. 41.—MAUNSELL'S METHOD. (MAUNSELL.)

The suture is complete, the intussusception has been reduced, and the opening in the bowel below (B) has been closed.

insert two Lembert's sutures into each piece of gut, one at the convex border and the other close to the mesenteric attachment, about $\frac{1}{4}$ inch from the free edge. These are not tied, but the ends of the corresponding stitches are held together with clamp-forceps, and so define a line for the insertion of the row of interrupted sutures. They also raise up a ridge on the serous surface which renders the introduction of the Lembert's stitches more easy. The method is shown in Fig. 42. The two pieces of gut must now be turned over in order to insert a row of interrupted sutures going through

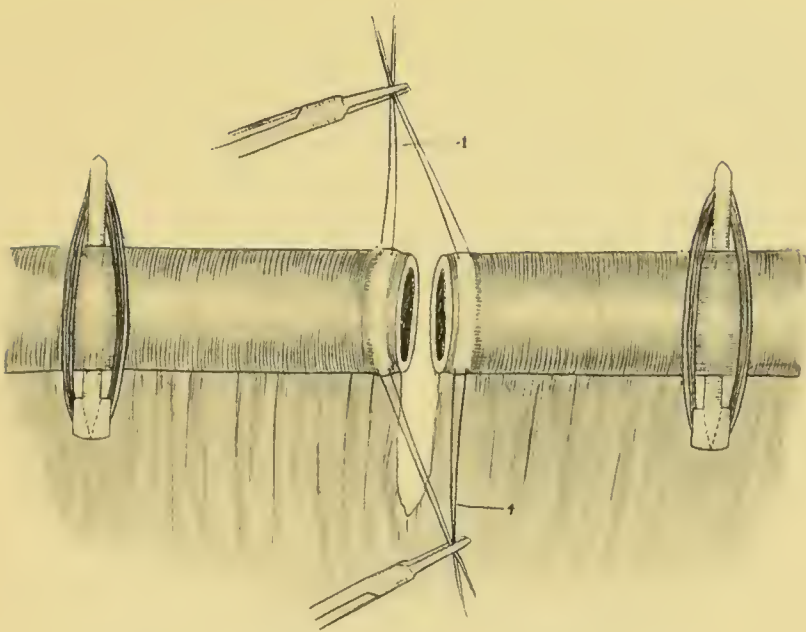


FIG. 42.—END-TO-END ANASTOMOSIS.

1, Sutures passed through the convex border of adjacent pieces of gut ;
4, sutures passed close to the mesentery. Two Lane's clamps
are seen in position.

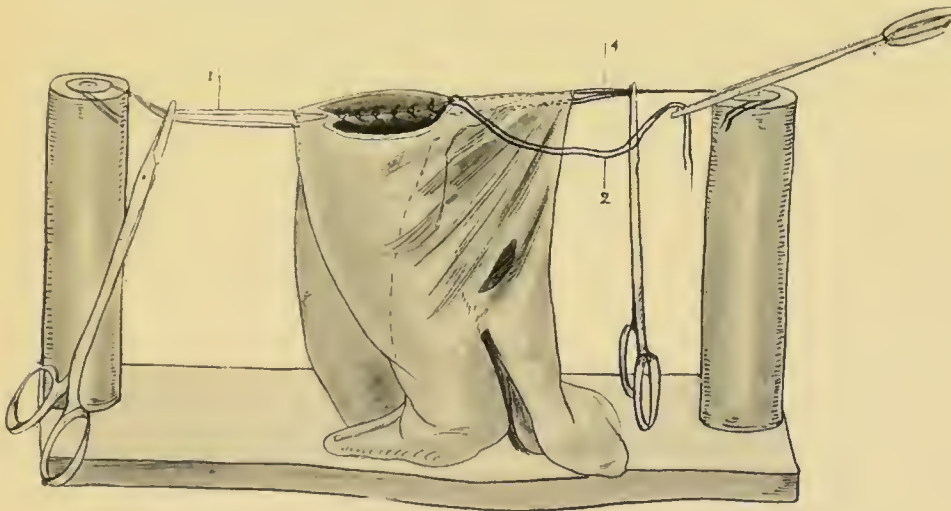


FIG. 43.—END-TO-END ANASTOMOSIS.

The pieces of bowel are held up by threads 1 and 4 by means of the intestine-holder. The row of sutures uniting all the coats has been passed, and the one next to the mesentery (2) has been left long and clamped.

all the coats of the bowel, whose knots will be inside the bowel. These are all tied, and the ends of the sutures cut short, with the exception of that nearest the mesentery, which is left long. This is marked 2 in Fig. 43.

The united piece of gut is then turned over and a row of Lembert's stitches inserted along the ridge raised by the guiding sutures. The two guides next to the mesentery (marked 4 in the figure) are then withdrawn, and two similar serous guides are inserted close to the mesentery on the other side of the gut (marked 3 in Fig. 44).

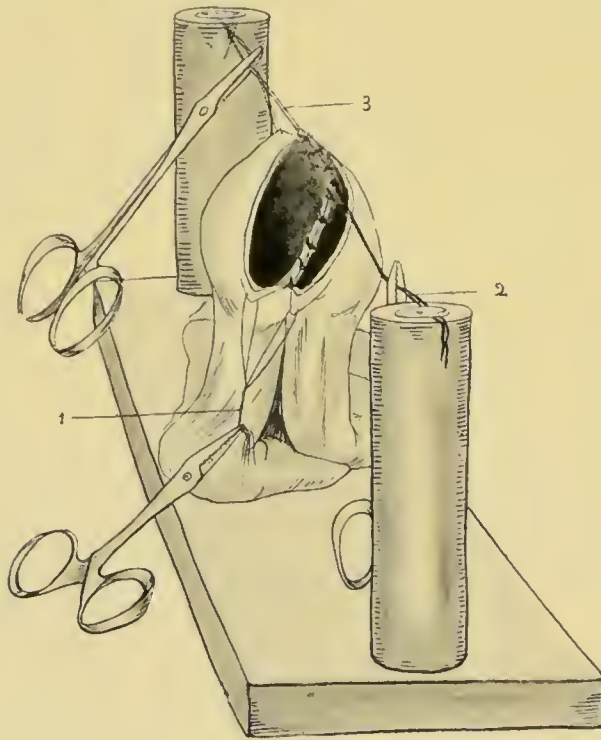


FIG. 44.—END-TO-END ANASTOMOSIS, SHOWING THE METHOD OF UNITING THE PORTION OF THE INTESTINE WITHIN THE LAYERS OF THE MESENTERY.

3. Two Lembert's sutures passed in corresponding points of the two ends close to the mesentery, but on the other side of the bowel to those marked 4 in the preceding figures.

These are then clamped together with forceps. Another pair of forceps is placed on the long ends of the suture (No. 2) which had been inserted on the inside of the bowel, close to the mesentery. On holding apart these two forceps, the portions of the circumference of each piece of gut between the layers of the mesentery will be accurately held in apposition, and a row of interrupted

sutures are placed through all the coats, uniting them together, the knots being tied inside the bowel. This is shown in Fig. 44. All these sutures are cut short, including the one which acted as a guide. The two guides first inserted in the convex portions of the bowel are now again seized with forceps and held apart from those last passed close to the mesenteric attachment.

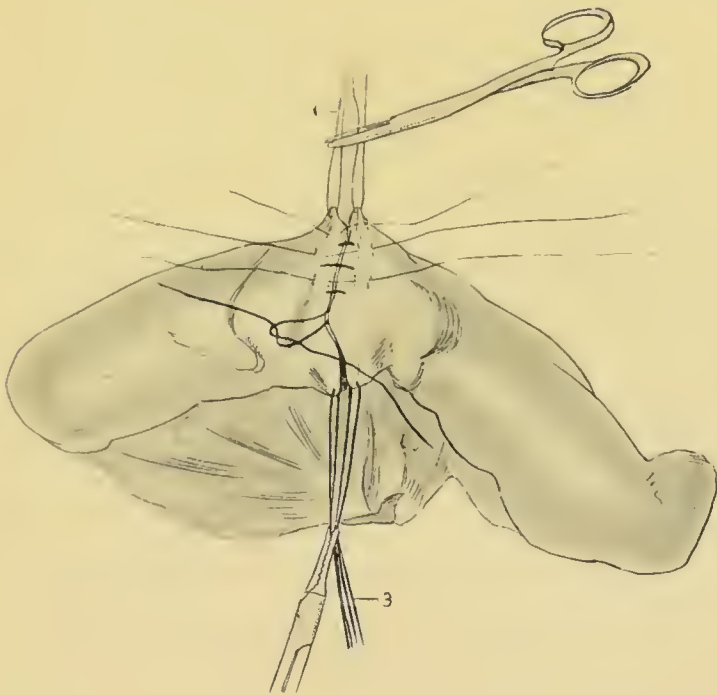


FIG. 45.—END-TO-END ANASTOMOSIS.

The numbers refer to the same threads as in the preceding figures. Closure of the third side of the triangle by two layers of interrupted stitches, in the same way as described in Figs. 18 and 19.

This is to show the line for the insertion of the sutures on the third side of the triangle. This portion of the anastomosis is completed in the way described before for the closure of a wound in the bowel—*i.e.*, by a double row of sutures, one passing through all the coats, which are passed so that the knots are inside the lumen of the gut, and the other a row of Lembert's. When these are inserted the two pairs of guides are withdrawn. The

operation is completed by the insertion of a mesenteric stitch.

One of the strongest is the following: An ordinary Lembert stitch is inserted in the mesentery $\frac{1}{4}$ inch from the margin of the gut and from the free edge. It is then inserted in a similar position on the opposite side, and the needle is carried through the whole thickness of the mesentery, and a Lembert stitch is inserted on the

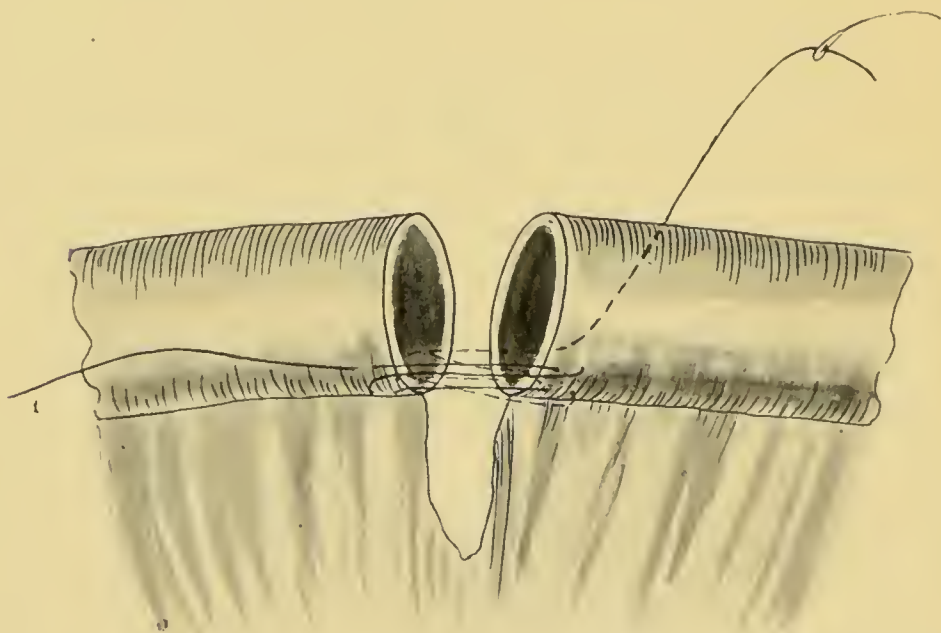


FIG. 46.—END-TO-END ANASTOMOSIS BY DOUBLE CONTINUOUS SUTURES.

The method of passing the continuous Lembert suture. The end (1) should have been tied, and the suture drawn tightly after each stitch. It is left loose to show the way the suture is passed.

other surface of the mesentery on each side. The needle is then again carried through the whole thickness of the mesentery, and made to emerge at the point of commencement of the stitch. On tightening the stitch the mesentery will be securely approximated on each surface.

3. In the hands of experts the method of a double continuous suture is the quickest, but it is certainly difficult to perform without producing constriction. Little need

be said of the method, as the principle is exactly the same as that for lateral anastomosis. A continuous Lembert is first passed. It is commenced with an ordinary stitch, which is tied about $\frac{1}{2}$ inch on one side of the mesenteric attachment, and is continued along $\frac{1}{2}$ inch of the other side. The suture should be inserted between $\frac{1}{8}$ and $\frac{1}{4}$ inch from the free edge, and includes the peritoneal and muscular

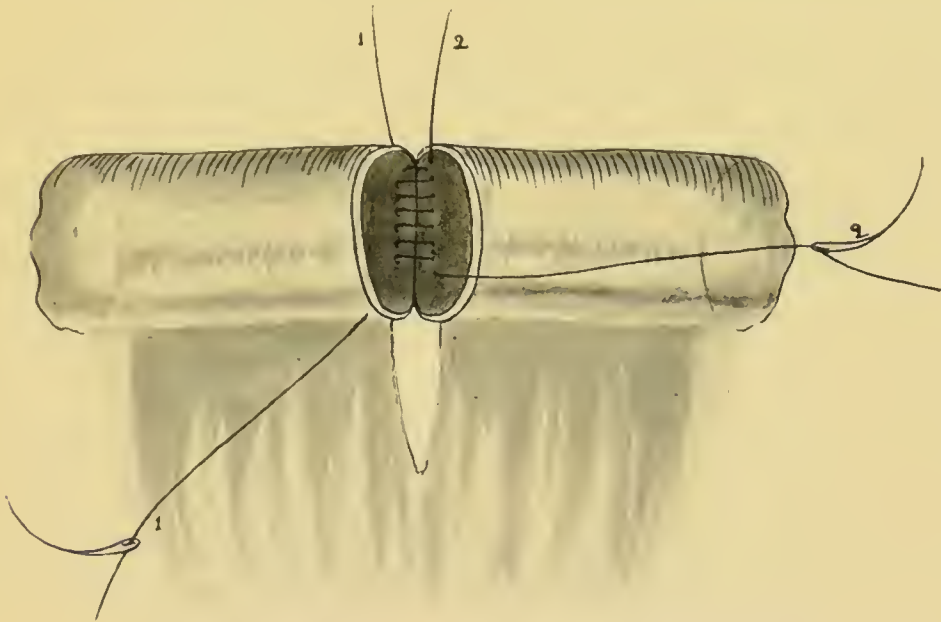


FIG. 47. — END-TO-END ANASTOMOSIS BY DOUBLE CONTINUOUS SUTURES.

The mesenteric portion of the two ends is united by a continuous suture passing through all the coats (2). The needle and end marked 1 are those of the continuous Lembert shown in the preceding figure.

coats only ; the stitches must be caught up every third stitch so as to prevent contraction. This needle is then laid aside, and another continuous suture is commenced about the same spot as the former, and made to penetrate all the coats of the bowel from within outwards. The suture is carried completely round the gut, taking care to oversew every third or fourth stitch. The end of the suture is united to the short end of the first knot, and the knot

tucked inside the lumen of the gut. The needle of the continuous Lembert is then taken up again, and this stitch carried all round the anastomosis just outside the former suture; it is then tied to the end left at its commencement. The anastomosis will then be complete.

This method, though difficult, should be practised, as it is the one employed when using bone bobbins, and it is desirable to be able to perform the simple suture before resorting to the aid of apparatus.

Anastomosis by Suture + Apparatus

These methods, again, we may divide into those where there is only a single row of sutures, and those where there are two rows.

A single row of sutures includes (1) O'Hara's clamp

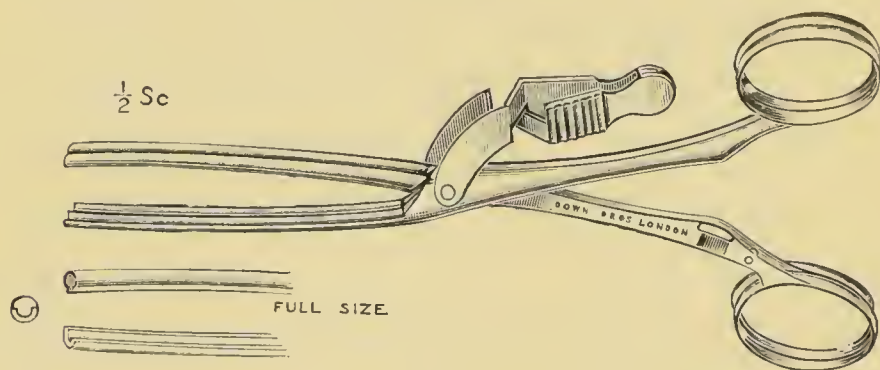


FIG. 48.—O'HARA'S CLAMP FORCEPS. (DOWN BROS.)

The two clamps are fastened together by the spring clip.

forceps, (2) Laplace's forceps, and (3) Halsted's rubber bag.

1. **O'Hara's Clamp Forceps** consist of two pairs of bow-shaped intestinal clamps, about 4 inches long, which are united together with a clip. This is shown in Fig. 48. They can be used for either lateral or end-to-end anastomoses. In end-to-end anastomosis they are applied as follows :

One of the clamps is applied on either side of the loop of gut to be removed, and it is tightly clamped. Care is taken that each clamp is applied slantingly, and that its end extends as far as, but not beyond, the mesenteric border of the gut. The diseased portion of the gut is now cut away close to each clamp, and the mesentery treated as described before (*vide* p. 36).

The two clamps are now brought together, and are fixed together with their spring clip. A continuous Lembert's suture is commenced at the handle end of each clamp, bringing the serous surfaces of the two pieces of intestine together over the blades of the clamp. This

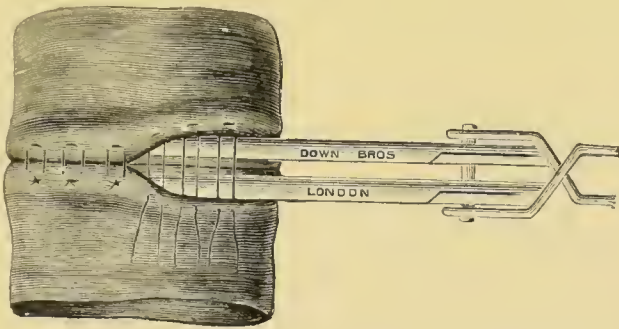


FIG. 49.—METHOD OF PERFORMING END-TO-END ANASTOMOSIS BY HALSTED'S SUTURE OVER O'HARA'S FORCEPS. (DOWN BROS.)

is continued completely around the gut, taking care to pick up the mesentery of each end in passing. The clamps are now disconnected, loosened, and withdrawn separately, and the hole through which they were withdrawn is closed by the continuous suture. The anastomosis is now complete. The anastomosis may also be effected by a row of Halsted's sutures, as shown in Fig 49. The objections to this method are (*a*) that a special apparatus is necessary, and will not always be at hand; (*b*) that a portion of the wall of the gut is apt to slip out from the clamp before the suture is complete; (*c*) that it is difficult to insure that the continuous

suture is tightly applied over the forceps; (*d*) that adhesions may take place between the walls of each piece of gut and cause cicatricial contraction; and (*e*) that a considerable diaphragm will be left at the site of union.

It is, however, easy of application, and does away

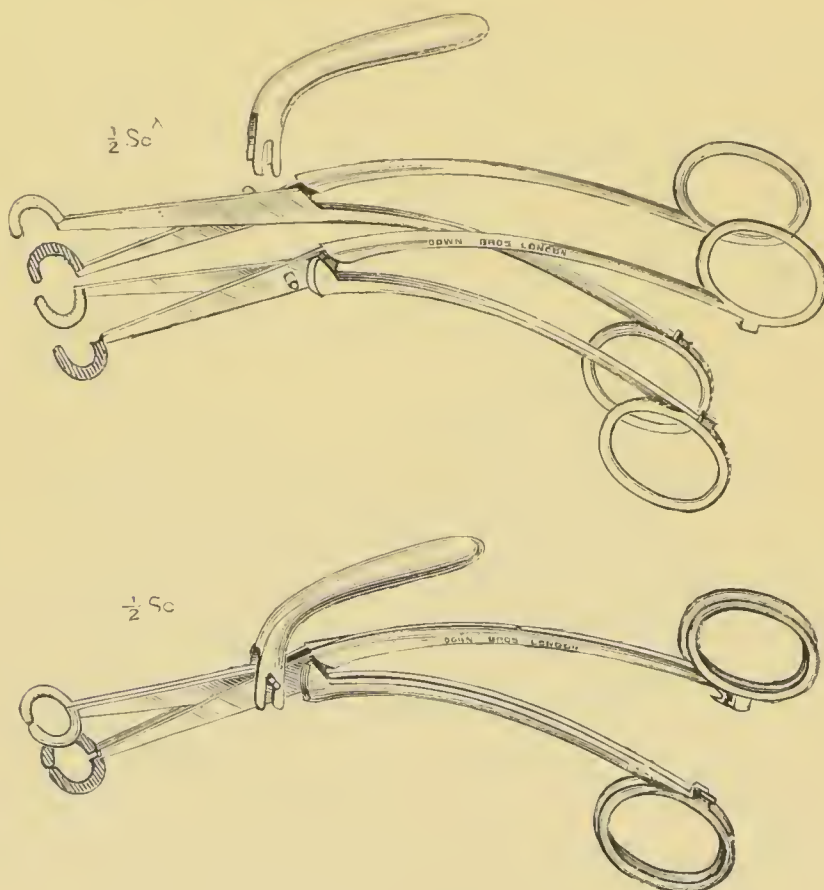


FIG. 50.—LAPLACE'S FORCEPS. (DOWN BROS.)

The upper figure shows the two clamps separate, and the lower one the two clamps united with the spring clip.

with the necessity for any further clamping the bowel on either side of the anastomosis.

2. **Laplace's Forceps.**—These are shown and described, because the illustrations and description make them appear very simple. In practice, however, they are not at all easy to apply. The forceps when united together consist of two rings between which the

ends of the two portions of gut are clamped. Each half of the forceps consists of a semicircular clamp, and they are connected together by a spring clip. In end-to-end anastomosis they are used as follows :

The two cut ends of intestine are first united by four fixation stitches passed through all the coats at the four cardinal points—*i.e.*, the mesenteric and convex borders and midway between these on each side. This insures the exact apposition of the mesentery of the two ends. The two halves of the forceps are next introduced separately between two of the sutures, and are then connected together with the clip. The forceps, which now form a complete ring, are opened so that one ring blade is in each end of the gut. The serous surfaces are inverted and drawn between the blades. This is facilitated by passing a ligature round the ends ; the forceps are then clamped, when serous membrane should be in apposition to serous membrane. The part to be sutured can then be held up by the forceps, and a continuous Lembert's suture is commenced close to the handle of the clamp on one side, and is carried round the intestine to the handle of the clamp on the other side, or Halsted's suture may be used. The clamps are then disconnected, and each half is unclamped and removed separately. The continuous suture is then carried over the hole from which the clamps were removed. The anastomosis is complete.

This method is open to all the objections which I raised to O'Hara's forceps, but it has even a greater fault, and that is, it is often extremely difficult to apply, the trouble being to get the whole of the circumference of the gut ends between the blades of the forceps unless a much larger number than four fixation stitches be first inserted. It is also very hard to get just the right amount of bowel wall invaginated ; it is easy to get too much, the result

being a valve-like projection at the line of suture, which might cause obstruction.

I can find nothing to say in favour of the forceps. I have only included them in my demonstrations so as to show the difficulties of so-called aids to anastomosis.

3. **Halsted's Rubber Bag.**—This consists of a rubber cylinder about $2\frac{1}{2}$ inches long, of about the same diameter as the intestine; a small rubber tube is inserted at its centre, by which the cylinder can be distended (see Fig. 51). It is employed as follows: Four stay sutures are inserted at the four cardinal points of the intestine, each stitch passing through all the coats.

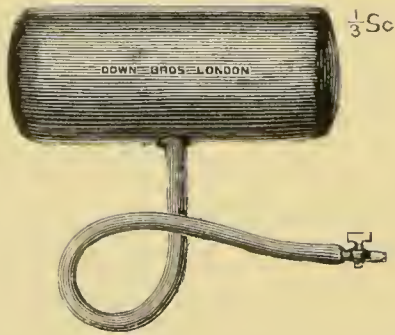


FIG. 51.—HALSTED'S AIR CYLINDER. (DOWN BROS.)

These are tied, and the ends cut short. The rubber cylinder is then introduced in a collapsed state between two of the sutures, and is then distended and the tube clamped (see Fig. 52). A row of Halsted's mattress sutures are then inserted all round the anastomosis, special care being taken with the stitch at the mesentery, which is made to penetrate both sides of each piece of mesentery. All these stitches are tied, with the exception of three at the centre of the convex border, which are left untied. The clamp is then taken off the rubber tube, and the collapsed cylinder can easily be withdrawn. The three remaining stitches are then tied,

and the anastomosis is complete. A very fine joint is made, and the bag enables the stitches to be passed in a straight line, and makes it easy to pick up the sub-mucous coat. There is also very little contraction of the line of suture. The objections to its use are (*a*) that it is a special apparatus, and may not be at hand when wanted; (*b*) that the union is effected by a single row of sutures only (this, however, is not serious, since it is a very secure one); (*c*) that the bag may be pricked

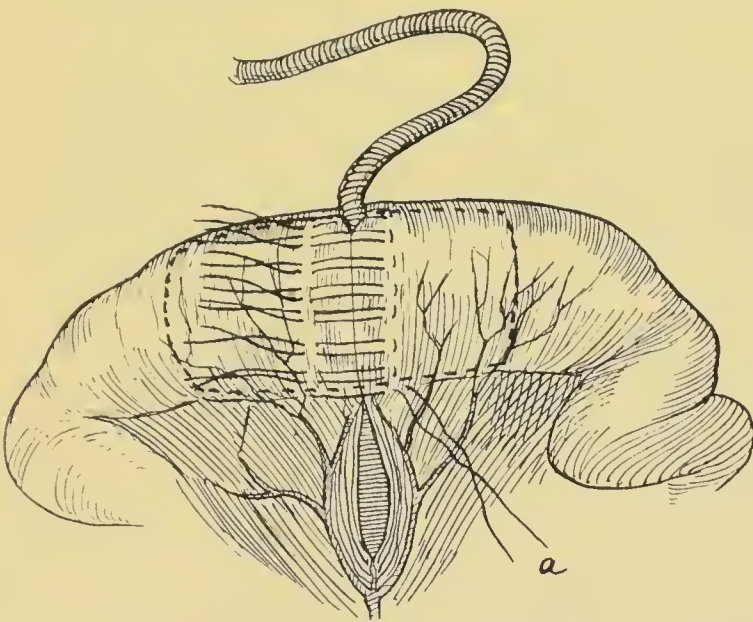


FIG. 52.—HALSTED'S AIR CYLINDER IN POSITION. (AFTER GOULD AND WARREN.)

a, The mesenteric stitch.

by a stitch and collapse (this should not occur); and (*d*) that the bag is difficult to remove (which is not the case).

I consider it a good method, and it is certainly very easy to perform.

Anastomosis by Apparatus Combined with a Double Row of Sutures

Under this heading are included the various bobbins made of decalcified bone, raw hide, potato, or other substances. The most generally used are :

1. Mayo Robson's bone bobbin.
2. Allingham's bone bobbin.

Both bobbins can be used in a similar manner, and the largest-sized bobbin which can be introduced into the intestine should be selected. The chief difficulty about the operation lies in the insertion of the posterior part of the continuous sutures before the introduction of the bobbin. Unfortunately, it is usually necessary to insert both of these before the bobbin is applied, as it is often almost impossible to accurately bring together the serous surfaces of the mesenteric portion of the gut after the bobbin is in position.

The operation with **Mayo Robson's Bobbin** should

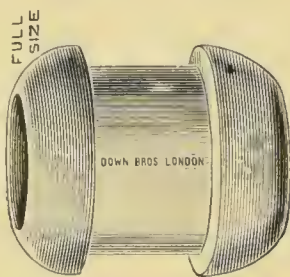


FIG. 53.—MAYO ROBSON'S BONE BOBBIN. (DOWN BROS.)

be performed as follows: Each loop of the bowel is clamped about 2 inches from the cut end. A straight or curved sewing-needle, armed with a long fine silk suture, is then used to unite the serous and muscular coats of the two pieces of gut, commencing about $\frac{1}{2}$ inch from their mesenteric borders and $\frac{1}{4}$ inch from their free edges. This is tied at its commencement, and the ends left long. With one end a continuous Lembert or Dupuytren stitch is carried round the posterior part of the line of union in the same way as described for union by simple suture (*vide* p. 46). When the suture has been carried to a point $\frac{1}{2}$ inch the other side of the mesenteries, it is laid aside and clamped. Another

needle, armed with a silk or catgut thread, is now taken, and the two edges of the bowel are united by another continuous suture penetrating all the coats, and passed from within outwards. It is commenced about the same place as the first stitch, and the commencing stitch is tied with its knot inside the mucous membrane, and its ends left long. It is then carried along the posterior edges of the bowel for the same distance as the peritoneal

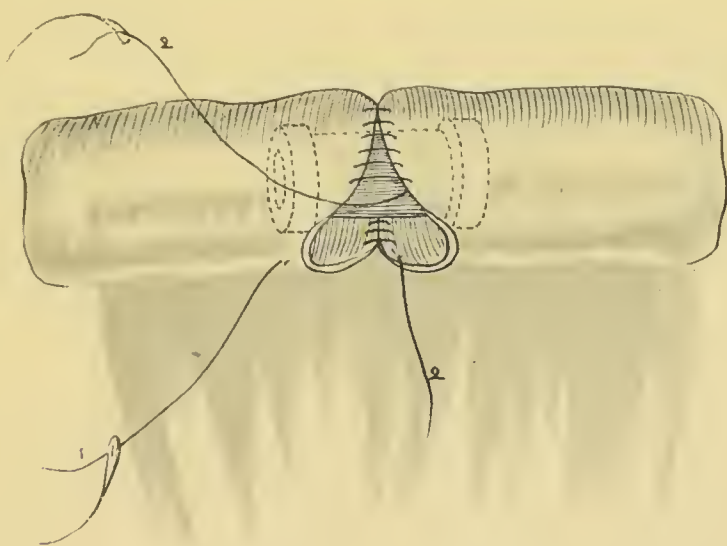


FIG. 54.—MAYO ROBSON'S BOBBIN IN POSITION. (AFTER MAYO ROBSON.)

- 1, The needle and thread of the preliminary continuous Lembert's suture ; 2, the suture which passes through all the coats.

stitch. When a bobbin is used it is unnecessary to catch up the suture at each fourth stitch ; all that is required is to pull each thread as tightly as possible. The ends of the stitch are held up by an assistant, and the bobbin is inserted by laying its centre on the sutured posterior lip of the anastomosis, and drawing the ends of the gut over it with dissecting forceps. When it has been placed in position, it is held there by the finger and thumb of the surgeon or his assistant. The second

row of suture—*i.e.*, that penetrating all the coats of the bowel—is then continued completely round the anastomosis to the point at which it had been commenced. It is then tied to the end left at the commencement of the stitch, and its knot tucked inside the mucous membrane. The bobbin will now be firmly fixed in position, and as there can be no further risk of any faecal escape, the clamps should be removed. The needle used for the first suture—*i.e.*, that uniting the serous coats only—is taken

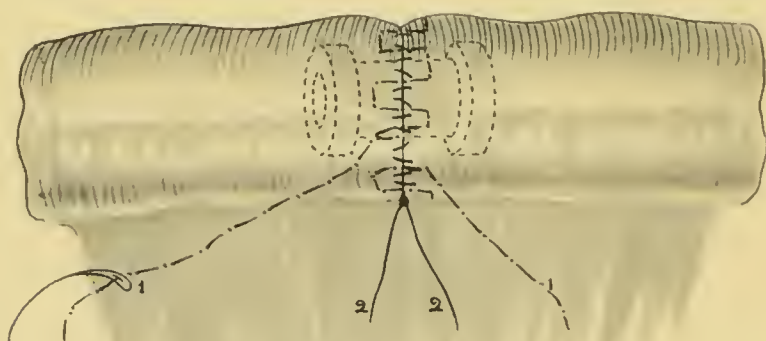


FIG. 55.—MAYO ROBSON'S BOBBIN IN POSITION, THE SUTURES COMPLETED. (AFTER MAYO ROBSON.)

- 1, The continuous Lembert (dotted line); 2, the continuous suture passing through all the coats. The knot of suture 2 should be tucked inside the bowel.

up again, and with it the continuous Lembert's stitch is carried completely round the anastomosis covering, in the inner or penetrating suture. When the point of the commencement of this suture is reached it is tied to the end which had previously been left long; the anastomosis is then complete. If a straight needle be used, it will be found easier to employ a continuous Cushing stitch rather than a Lembert.

This method, it will be seen, is not very easy, on account

of the difficulty in inserting the first part of the continuous Lembert's or Cushing's suture, and you will see that the bobbin is of no assistance until the difficult mesenteric part of the anastomosis has been completed. In cases, however, where the mesentery is sufficiently long to enable one to bring the two cut ends of bowel outside the abdominal incision, the operation can be much simplified by leaving the whole of the peritoneal suture until after the bobbin has been placed in position. The two pieces of intestine are held in apposition, and a continuous suture is made to unite all the coats of the mesenteric half of each portion of intestine; the bobbin is inserted and held in position while this suture is com-

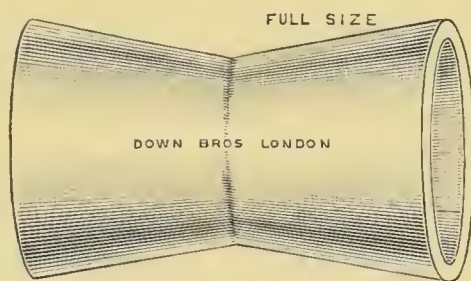


FIG. 56.—ALLINGHAM'S BONE BOBBIN. (DOWN BROS)

pleted as described above. A continuous sero-muscular suture is then inserted all round the anastomosis, starting near the convex border, and paying particular attention to the inclusion of a sufficient amount of mesentery in the stitch.

Allingham's Bobbin.—Most surgeons use Allingham's bobbin in exactly the same way as has been described for the application of Mayo Robson's, and it acts equally well. The inventor himself advocates an easier and quicker method of employing it. A purse-string suture is inserted round the end of each piece of gut in the same way as is done before the introduction of a Murphy's button (see p. 60). The bobbin is then

introduced into the opening of one piece of gut, and the opening in the other piece of gut is drawn over the other end of the bobbin. The purse-string sutures are then tied tightly round each piece of gut, fixing it on to the bobbin, whose gutter-like shape will prevent the gut from slipping off (see Fig. 57). The two portions of gut are now united by some interrupted serous sutures, or by a



FIG. 57.—ALLINGHAM'S BONE BOBBIN IN POSITION. (ALLINGHAM.)

continuous suture taking up the serous and muscular coats. It will be seen that this method is very easy to perform, but it is liable to be followed by considerable contraction, since not only has each end been constricted by the purse-string sutures, but the continuous serous suture will be at some distance from the line of union, and so will cause a good deal of valvular projection within

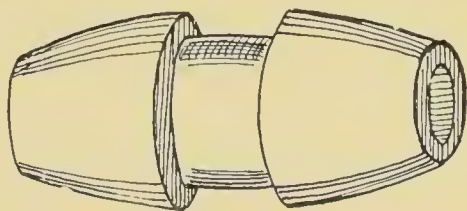


FIG. 58.—LANDERER'S POTATO BOBBIN. (GOULD AND WARREN.)

the lumen of the gut at this point. The method should only be used in a case where extreme haste is necessary.

Landerer's Potato Bobbin consists of a piece of raw potato, which is cut into the shape shown in Fig. 58. It is used in precisely the same way as Allingham's bobbin. It will not be so readily absorbed as decalcified bone.

Anastomosis by Apparatus Alone

There is only one method which needs description in this class, and that is Murphy's button. This is of undoubted value where extreme rapidity of execution is desirable, as when the patient is in a very grave condition. It, however, does not yield very satisfactory results, since the separation of the button takes place by sloughing of the opposed portions of intestine, and union may not be firm when the slough separates, and so extravasation may occur. Again, the button, after being passed on, may cause fatal ulceration and perforation at some point below, or it may cause obstruction at the

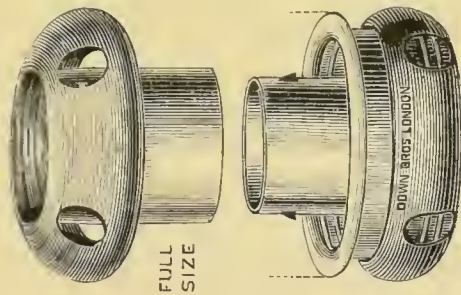


FIG. 59.—MURPHY'S BUTTON. (DOWN BROS.)

ileo-cæcal valve, and require a second operation for its removal. In the case of lateral anastomosis it is open to the further objection that it causes an actual obstruction till it separates.

The button is made in various sizes, but the two principal ones are those for small and large intestine. It is too well known to require any detailed description; the accompanying diagram (Fig. 59) explains its mechanism.

The two halves are approximated by simply pushing them together, but they can only be separated by unscrewing. One half only has a spring, and this end is the heavier, and must always be placed in the lower segment of intestine.

It is applied in the following way :

A purse-string suture is inserted round the edge of each piece of the gut. It is commenced opposite the mesenteric border, and it is best to oversee the edge of the gut, as shown in Fig. 60. When arriving at the

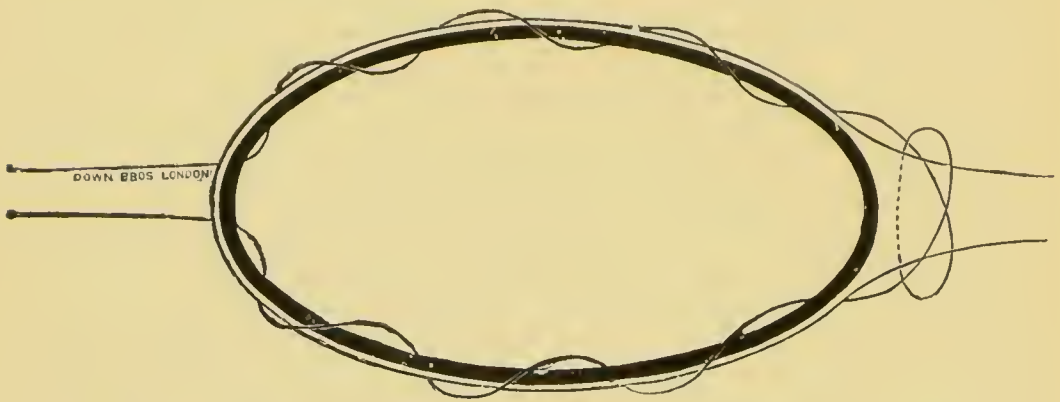


FIG. 60.—PURSE-STRING SUTURE ROUND INTESTINE, SHOWING DIRECTION OF STITCH AT MESENTERY. (DOWN BROS.)

mesentery, it is important to pick up both peritoneal surfaces of the mesentery of each end in the running stitch, so as to insure that they are brought within the button. This is done by passing the purse-string suture

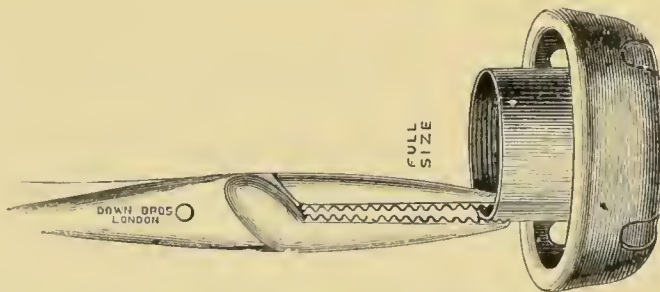


FIG. 61.—METHOD OF HOLDING ONE HALF OF BUTTON PRIOR TO INTRODUCTION. (DOWN BROS.)

along the edge of the gut from *right* to *left* as far as the mesentery, then passing the suture through the mesentery from *left* to *right*, and then continuing it along the remainder of the edge of the gut from *right* to *left*; this forms a double loop at the mesentery.

When the gut is completely encircled with the suture, one half of the button is held by a pair of artery forceps, and inserted sideways into the opening; when the button is within the lumen of the gut, the running stitch is tightened and tied, any redundant mucous membrane is then snipped off, the end of the gut being tucked within the button with a pair of dissecting forceps. The other half of the button is inserted into the other piece of gut in a similar way, and the running stitch is tightened. Before bringing the two halves of the button

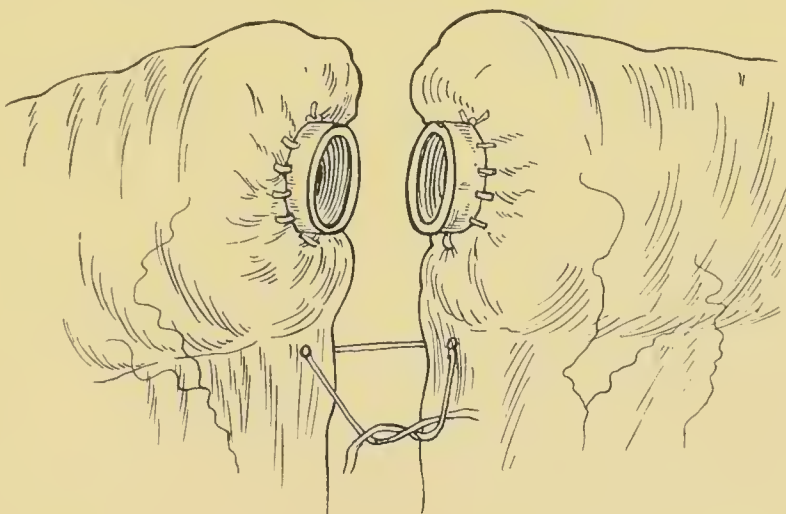


FIG. 62.—BOTH HALVES OF BUTTON IN POSITION, MESENTERIC STITCH PASSED. (AFTER GOULD AND WARREN.)

together it is well to insert a stitch in the edge of the mesentery at each end, which insures accurate contact at this point when the button is approximated; this is shown in Fig. 62. The two halves of the button must be pushed together very gently, and it must be remembered that it is impossible to rectify any mistake in position when once the button has been closed up; the only way is to cut it out of the intestine and start afresh. The two halves do not require to be absolutely jammed together, since it is best that the actual contact of the intestinal walls should be maintained by the action of

the spring. When the button is closed the mesenteric stitch is tied, and one or two stitches uniting the mesentery complete the operation. Some surgeons have recommended a supporting row of Lembert's sutures, but Murphy himself was very adverse to this as being unnecessary, and, moreover, as acting as a hindrance to the passage onwards of the button, and likely to cause a valve-like obstruction at the line of union after the button was passed.

This is a method that everyone should be familiar with, and though its application seems very simple in a book, it requires some care and practice to insure that no mucous membrane overlaps the serous when the button is closed; this, of course, would lead to failure of union and extravasation. The button separates by means of necrosis of the opposed pieces of gut, and it usually takes about ten days to pass down the intestinal canal. In some cases it has been retained for as long as forty days, and in most cases of gastro-enterostomy it remains permanently in the stomach. The indication for the employment of the button is the necessity for the rapid termination of an operation.

CHAPTER IV

SPECIAL OPERATIONS

On the Stomach

THE operations which are most often called for are (1) suture of a ruptured gastric ulcer or of a wound of the stomach, and (2) gastro-enterostomy.

1. In suture of a gastric ulcer it is seldom advisable to attempt to excise the ulcer, as the surrounding walls of the stomach will be found to be infiltrated with inflammatory products, and so a very large area would have to be removed in order to get to healthy tissues. The best method of closing a ruptured gastric ulcer is by means of a double row of Lembert's or Halsted's sutures, and the first row of these must be placed at some little distance, about $\frac{1}{2}$ inch, from the ulcer; it necessarily follows that the row must be continued for about $\frac{3}{4}$ inch beyond the limit of the ulcer of each end; this is shown in Fig. 63.

In some cases these Lembert's or Halsted's sutures will be found to cut out as soon as an attempt is made to tie them. In such cases a purse-string suture should be passed round the ulcer at a distance of about $\frac{1}{2}$ inch outside it. The stitch must penetrate the muscular and submucous coats. The ulcer is invaginated when the stitch is tied; this is shown in Fig. 64. The suture

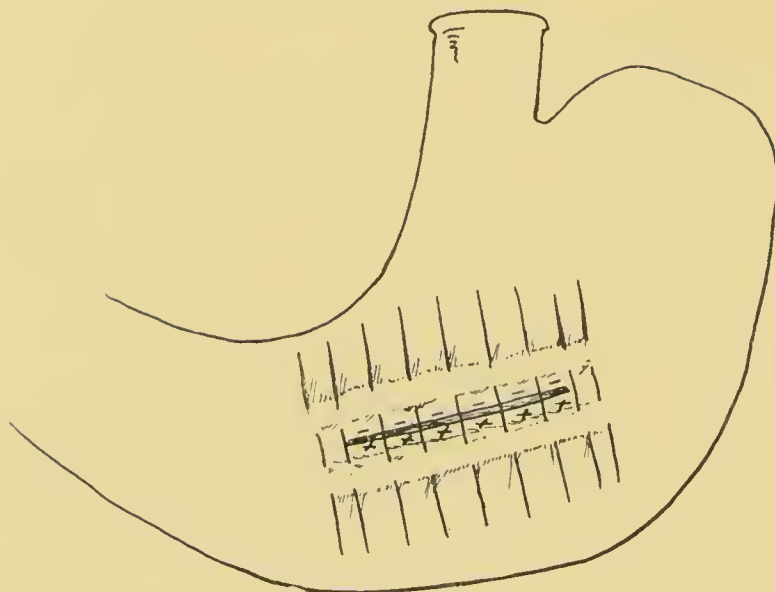


FIG. 63.—CLOSURE OF A RUPTURED GASTRIC ULCER BY DOUBLE ROW OF SUTURES.

The first are Halsted's sutures, which have been tied. A row of Lembert's have been passed outside these, but are not tied.

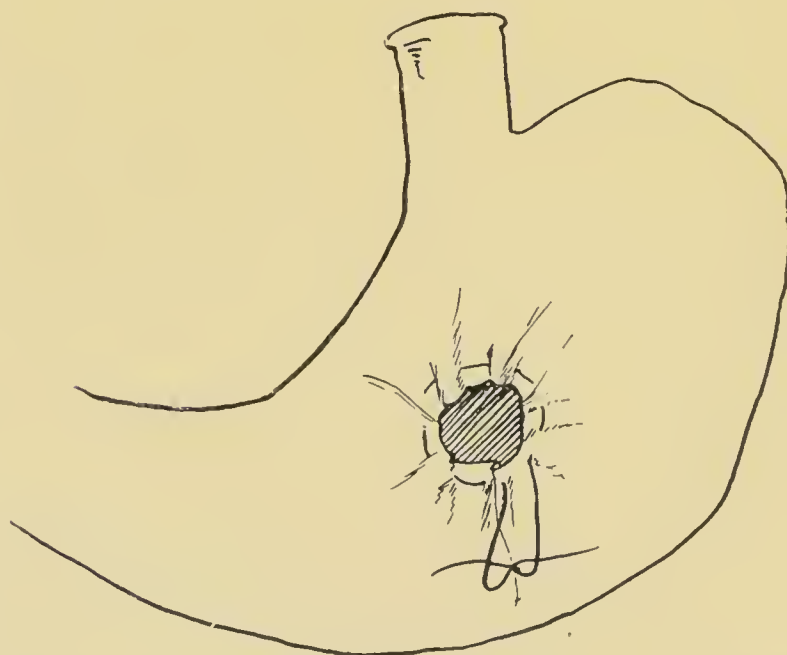


FIG. 64.—CLOSURE OF A RUPTURED GASTRIC ULCER, SECOND METHOD.
A purse-string suture passed round the ulcer at a distance from the perforation.

may to advantage be reinforced by the application of a piece of omentum over the site of the ulcer.

In the case of a clean-cut wound, or of a rupture of a healthy stomach, the opening should be closed by a double row of sutures, the first ones going through all the coats of the stomach, and the others taking up the serous and muscular coats only. Continuous sutures should not be employed, on account of the puckering of the stomach walls which would be caused.

2. Gastro - Enterostomy.—This operation is of great value, and when performed as an adjunct to suture of a gastric ulcer, it will aid the cicatrization of the sutured ulcer by preventing any distension of the stomach with flatus or food. The operation is also frequently performed with very beneficial results in cases of intractable gastric ulcer and in old-standing chronic gastritis, in addition to cases of dilatation of the stomach due to organic obstruction at the pylorus. The organic obstruction may be due to cicatricial contraction after ulcer, to adhesions from without, or, lastly, to malignant disease.

There is a very great choice of methods of establishing a new opening out of the stomach. The old operation of gastro-duodenostomy is not to be recommended, on account of the fixed position of the duodenum, and it is now almost always the rule to attach the jejunum to the stomach. The first part of the jejunum can be readily found by turning up the great omentum and transverse colon, and feeling for a piece of gut just to the left of the first lumbar vertebra, as shown in Fig. 65 ; this is hooked out of the wound with the finger, and pulled upon until no more gut comes, showing that the beginning of the jejunum has been found. The coil of gut is then allowed to become slack, and a point about 6 to 9 inches from its commencement should be selected

for the anastomosis. We have then to decide whether to unite the jejunum to the anterior or to the posterior surface of the stomach ; if it is decided to perform an anterior gastro-enterostomy the loop of jejunum is made to pass up over the transverse colon, and is applied to the anterior surface of the stomach. In doing this the following points must be particularly attended to: (1) The loop must be applied to the stomach at a sufficient distance from its commencement, so that there will be

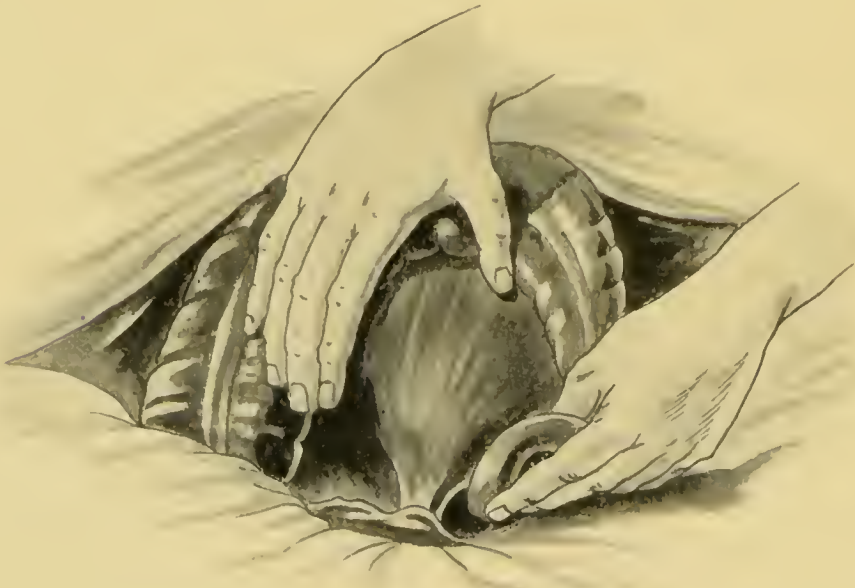


FIG. 65.—FINDING THE FIRST PART OF THE JEJUNUM. (AFTER CHEYNE.)

The transverse colon has been turned upwards, and the jejunum found at the left border of the first lumbar vertebra.

no compression of the colon by its being stretched over it ; (2) the loop must be so applied that the peristaltic waves in the stomach and in the jejunum shall be in the same direction ; and (3) it should be applied in a slanting direction from above downwards, so as to favour the passage of the stomach contents from the stomach into the efferent rather than the afferent portion of the intestine.

Having paid attention to these points, the anastomosis may be done by Halsted's method in a precisely similar manner to that described for lateral intestinal anastomosis (*vide* p. 28); this is shown in Figs. 66, 67, and 68. This method has given very good results in my hands, and I have almost invariably employed it.

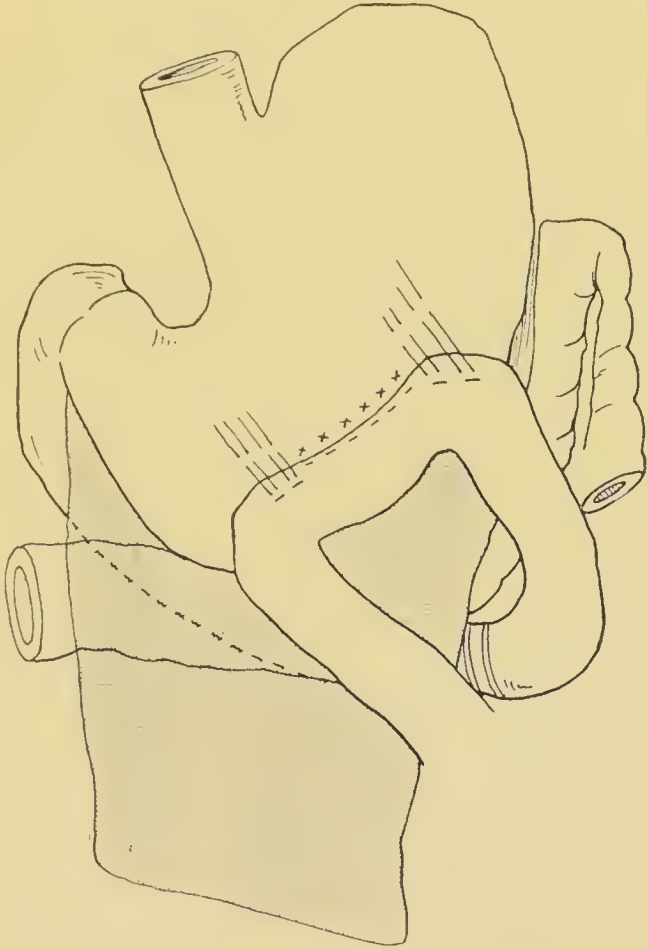


FIG. 66.—ANTERIOR GASTRO-JEJUNOSTOMY BY HALSTED'S METHOD.
The posterior row of sutures have been passed and tied. The corner stitches have been passed, but have not been tied.

Many surgeons, however, prefer a double continuous suture after Wölfer's method, and this requires no special description.

It only remains to speak of the use of bone bobbins and Murphy's button. I am inclined to consider these abso-

lutely unsuitable for lateral anastomosis, since while the bone bobbin is *in situ* the opposite wall of the jejunum will completely occlude the opening in the bobbin or button, and the result will be that no food can pass out of the stomach until the bobbin has become absorbed or has been passed. It will, therefore, usually be found

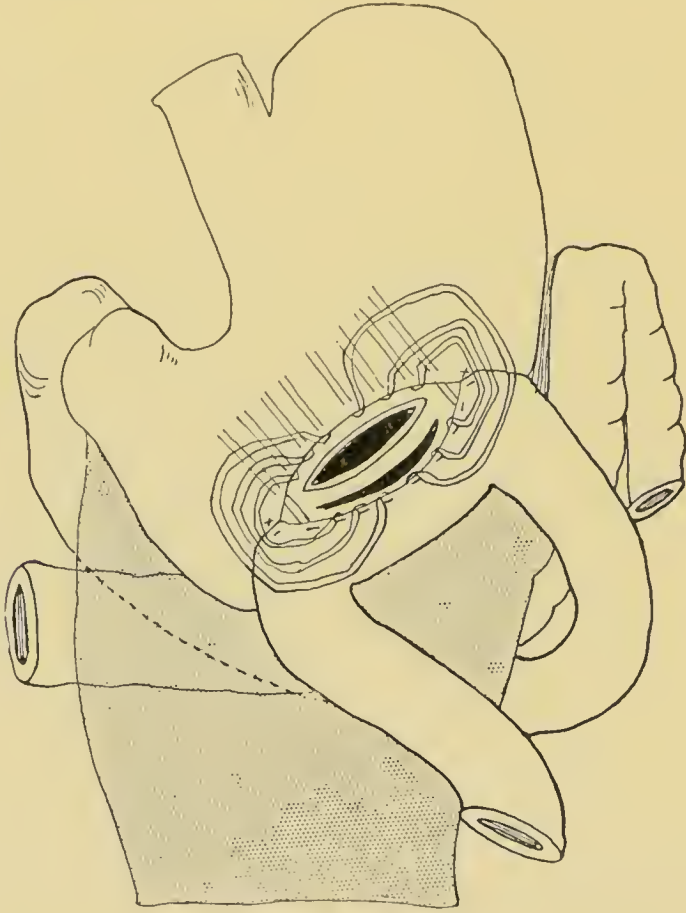


FIG. 67.—ANTERIOR GASTRO-ENTEROSTOMY BY HALSTED'S METHOD. All the stitches have been passed, and those of the anterior row have been drawn aside to allow the openings to be made.

that operations where these are employed are followed by sickness for the first few days. Murphy's button is open to the further objection that it has an irresistible tendency to pass backwards into the stomach instead of into the jejunum, and in such cases a second operation is necessary to remove the button.

If it be decided to unite the jejunum to the posterior surface of the stomach, this can best be effected by turning up the transverse colon and tearing a hole in the transverse mesocolon, so as to enter the lesser peritoneal cavity. In doing this care should be taken to reach the posterior surface of the stomach at a little

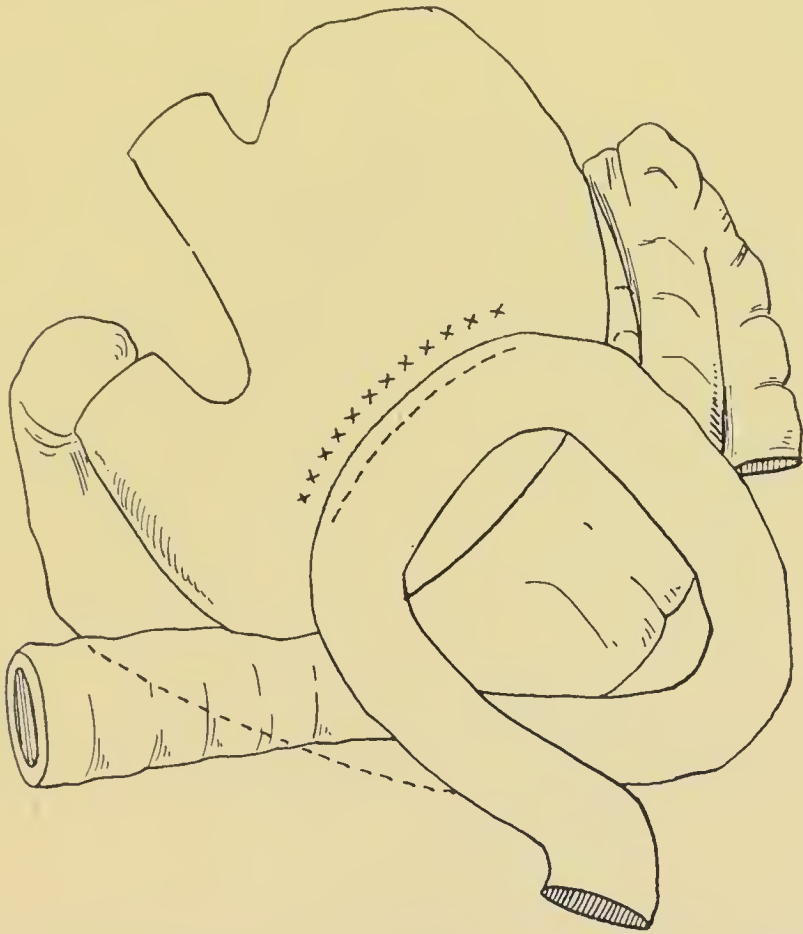


FIG. 68.—ANTERIOR GASTRO-ENTEROSTOMY BY HALSTED'S METHOD.
The operation completed.

distance from the pylorus, since the anterior wall of the lesser cavity is often adherent to the stomach close to the pylorus, and, moreover, in this part of the stomach the vessels are larger and more difficult to avoid.

Having thus exposed the posterior surface of the stomach, the jejunum may be connected either by

Halsted's method or by a double continuous suture; the latter method is shown in Fig. 69.

In this operation care must be taken to make the

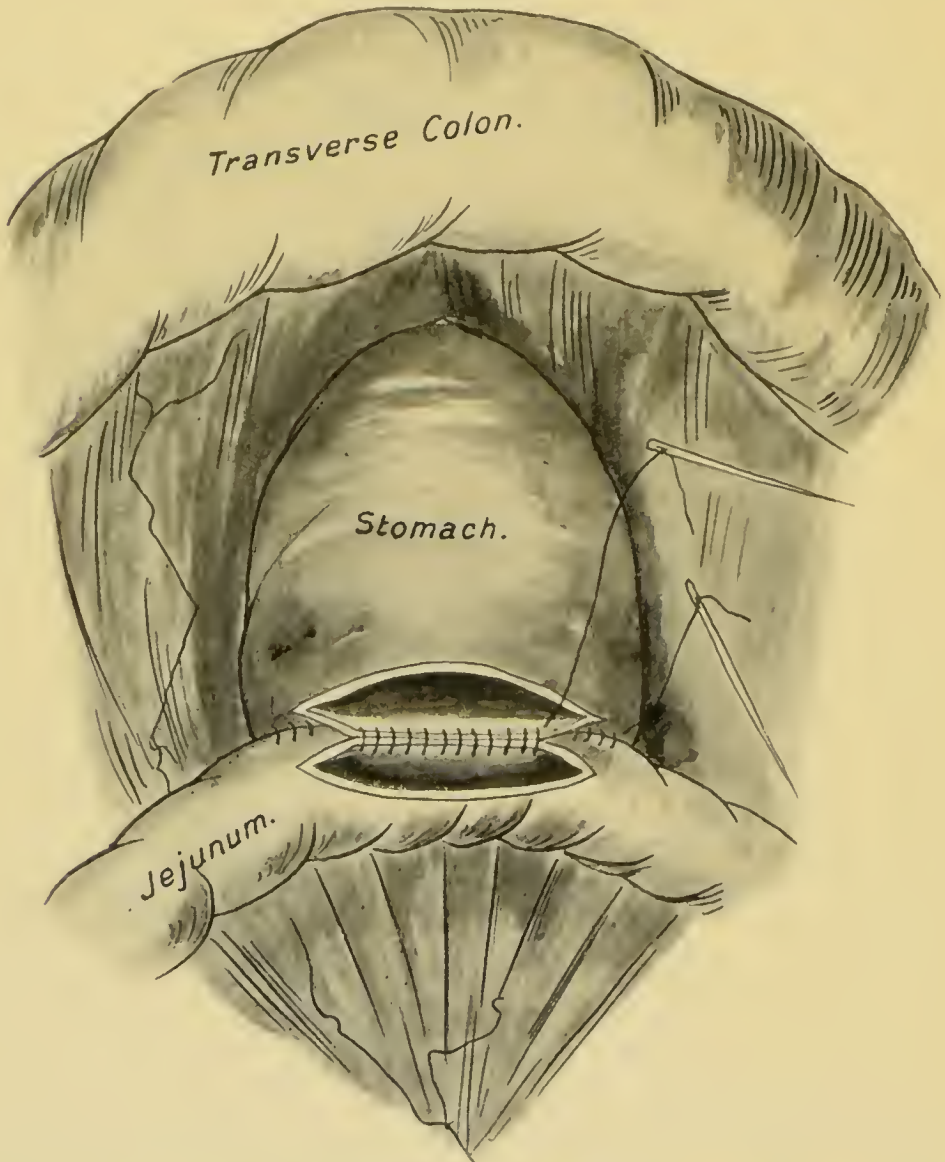


FIG. 69.—POSTERIOR GASTRO-ENTEROSTOMY BY DOUBLE CONTINUOUS SUTURE. (GOULD AND WARREN.)

The posterior portion of each suture has been passed.

anastomosis (1) so that the peristaltic waves in the stomach and jejunum are the same; (2) at a sufficient distance from the duodenum that a kink is not produced at the ligament of Treitz, which would obstruct the onward

flow of bile; (3) that no spiral twist takes place in the jejunum when the stomach is replaced within the abdomen; and (4) that the margins of the hole in the mesocolon are united to the stomach so as to avoid the danger of a hernia of small intestine through it: such a condition has occurred, and proved fatal.

One of the causes of failure after gastro-enterostomy has been the establishment of the so-called 'vicious circle.' This consists in the passage of the food into the afferent loop of the jejunum, and consequent return of the food mingled with bile into the stomach; this naturally gives rise to intractable vomiting and starvation. In order to obviate this, I have laid stress on the importance of attaching the jejunum in a slanting direction, and to unite the jejunum to the stomach for $\frac{1}{2}$ inch beyond the ends of the anastomosis, and this in my hands has prevented the accident in all but one case; some other surgeons seem to have been very unfortunate, and the condition is described as being of fairly frequent occurrence. To correct the condition, all that is necessary is to do a lateral anastomosis between the afferent and efferent loops below the anastomosis, when the food and bile will pass onwards in the proper way instead of returning to the stomach. This is shown in Fig. 70, which also represents a rather faulty gastro-enterostomy. The anastomosis can be done by Halsted's method, by a double row of continuous sutures, or by Murphy's button, if time is of consequence. In order to prevent the possibility of the establishment of a vicious circle, various operations have been devised, but I will only refer to one which has been invented by Roux, of Lausanne. This, however, is a more severe operation, and will take a longer time to perform. The posterior surface of the stomach is exposed in the usual way, and



FIG 70.—METHOD OF PERFORMING ENTERO-ANASTOMOSIS IN CASES OF 'VICIOUS CIRCLE.' (CHEYNE.)

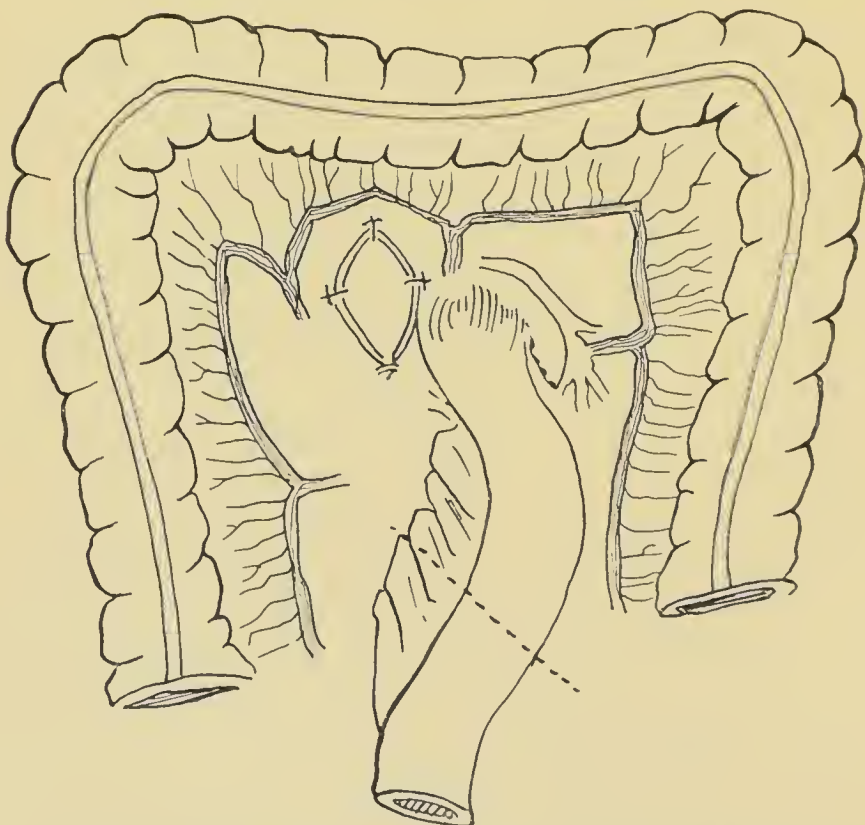


FIG. 71.—GASTRO ENTEROSTOMY BY ROUX'S METHOD.

The dotted line shows the point at which the jejunum is divided. The hole has been torn in the mesocolon.

the jejunum is then completely divided about 4 or 5 inches from the ligament of Treitz. The distal end of the jejunum is then implanted into the stomach by a double continuous suture, and the cut end of the proximal portion of the jejunum is then implanted into the convex border of the distal portion about 2 or 3 inches below the gastro-enterostomy; this is shown in Fig. 72.

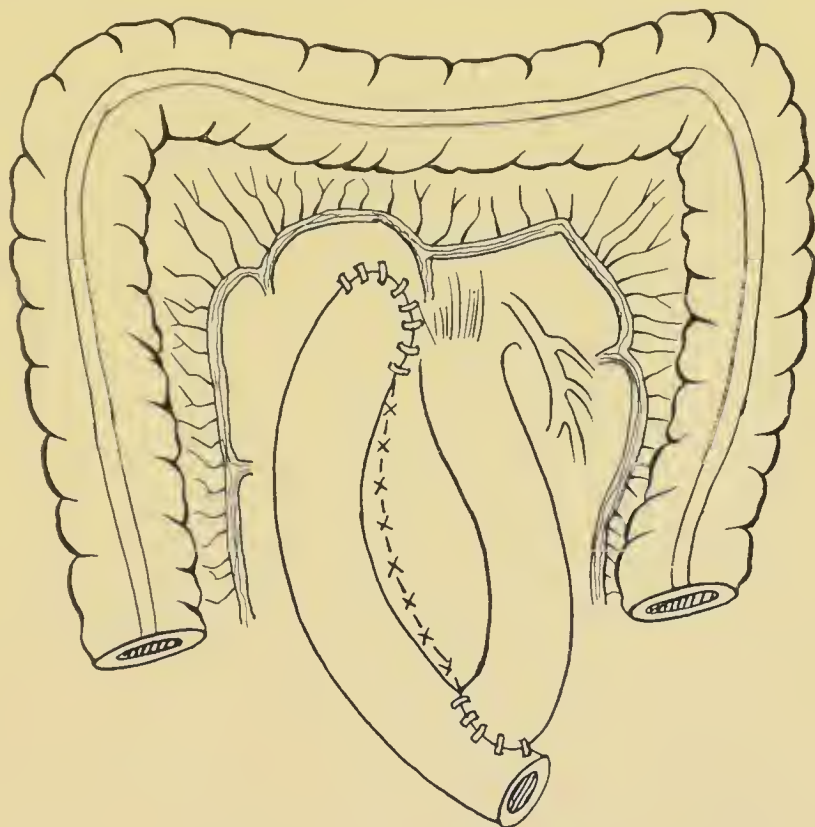


FIG. 72.—GASTRO-ENTEROSTOMY BY ROUX'S METHOD.

The operation completed.

It will be readily understood that no vicious circle is possible; the principal danger beyond shock will be the subsequent contraction of the opening between the stomach and jejunum.

*Comparison between the Different Methods of
Performing Gastro-Enterostomy*

Disregarding for the moment Roux's operation as being much more severe, and only permissible in patients who are in a very robust condition, we will consider first the main points in favour of the anterior and posterior operations, and then discuss the best methods of attaching the jejunum to the stomach.

The points in favour of the anterior operation are :

1. The greater ease in its performance, and consequently increased rapidity in operating.

2. The certainty of uniting the jejunum to the stomach in a slanting direction.

3. In the erect position the anastomotic opening will be at the lowest point of the stomach, since the weight of the attached small intestine will pull the anterior surface of the stomach downwards.

4. The avoidance of any injury to the transverse mesocolon, and the absence of any risk of hernia through the opening.

The disadvantages of the operation are :

1. The danger of compression of the transverse colon by the jejunum when the anastomosis is being made too close to its commencement.

2. When the patient is in the horizontal position the position of the opening will favour the passage of bile into the stomach, and will hinder the passage of stomach contents into the jejunum.

3. As the jejunum is so much displaced out of its ordinary position, there is a greater danger of a kink just beyond the anastomosis.

4. Distension of the transverse colon may press upon the jejunum and produce obstruction to the passage of bile.

On the other hand, the advantages of the posterior operation are :

1. The ready passage of stomach contents through the new opening when the patient is in bed.
2. The absence of any danger of constriction of the transverse colon by the loop of jejunum.
3. The absence of risk of a kink in the jejunum beyond the anastomosis.

The disadvantages are :

1. The greater difficulty in its performance, the necessary exposure of the transverse colon during the operation, and the increased shock.
2. The greater difficulty in attaching the jejunum in a proper direction to the stomach.
3. As the jejunum is attached to the middle of the posterior surface of the stomach, and the point of union is fixed to the hole in the transverse colon, the anastomosis cannot change its position when the patient stands up, and in the erect position the new opening is no longer at the most dependent part of the stomach.
4. The risk of hernia through the opening in the transverse mesocolon.

It will be seen that there is a great deal to be said for and against each procedure, and that neither is vastly superior to the other. Personally, I should recommend the anterior operation to a surgeon who had not done many cases, and leave the posterior operation to those who have had a large experience. My own practice has been to do a posterior operation in cases of obstruction from non-malignant stricture when the patient's general condition is good, and to do the anterior operation in cases of malignant disease and in non-malignant cases who are in a feeble condition.

I have had no personal experience of Roux's operation, and I am inclined to think it unnecessarily severe.

With regard to the best method of uniting the jejunum to the stomach, I have already stated my own preference for Halsted's method, but I have also operated by double continuous sutures, and my only objection to the method is the danger of subsequent contraction of the opening. With regard to Halsted's method, I know that the opening remains patent, as I have had opportunities of examining the opening more than two years after an operation.

The other operations on the stomach to which I refer are (1) pyloroplasty, and (2) pylorectomy.

1. **Pyloroplasty.**—This operation was recommended by Heinke and Mickulicz for the relief of pyloric stricture, and as a substitute for gastro-enterostomy.

It consists in the division of the stricture in a horizontal direction, and the suture of the resulting incision in a vertical direction.

It is performed as follows :

An incision is made through the entire length of strictured pylorus, and is continued into the healthy stomach and duodenum for at least $\frac{1}{2}$ inch on each side. It is easiest to make the incision into the stomach first, close to the pylorus, and then to pass a director through the stricture, and divide the pylorus horizontally with scissors ; the incision is then continued into the duodenum for $\frac{1}{2}$ inch. Two hooks are then inserted into the middle of the incision, and the opening is pulled apart so as to make a lozenge-shaped opening. A stitch uniting the whole thickness of the stomach is then placed at the angles of the original incision, and these are drawn together so as to connect the horizontal into a vertical opening. This is shown in Fig. 73.

Several other points of interrupted sutures going through all the coats of the stomach and duodenum are then inserted so as to completely close the opening. This supporting row of sutures is then covered in by a row of Halsted's sutures introduced in the ordinary way.

This operation is only applicable to fibrous strictures of the pylorus, and should never be done either in malignant disease or in cases where any active ulceration is present. It is open to the objection that, although the

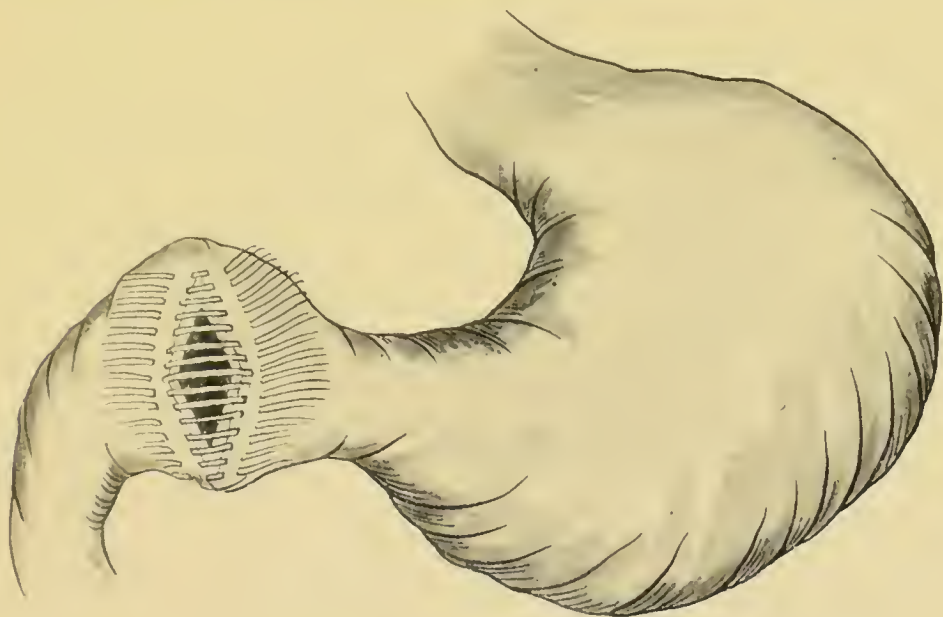


FIG. 73.—PYLOROPLASTY. (AFTER GOULD AND WARREN.)

A row of Lembert's sutures have been passed, and have converted the horizontal incision into a vertical one.

actual pyloric opening is enlarged by the manœuvre, it is apt to produce a kink at the pylorus, and, moreover, it is very liable to contract. A most important objection to its use lies in the fact that in a dilated stomach the pylorus is no longer the lowest point in the stomach, and so even if the pylorus be made patent the dilated stomach will not be able to empty itself, and the patient will suffer from the effects of decomposition of retained contents. In several cases in which I have employed this method

I have found it necessary to perform a gastro-enterostomy on a subsequent occasion. The risk of the operation in non-malignant cases is very slight.

2. **Pylorectomy.**—This is a very severe operation, and should be exclusively reserved for cases of malignant disease. Unfortunately, only a very few cases of cancer of the pylorus are capable of removal, since, by the time that a tumour can be felt through the abdominal wall, it is probably of such a size and is accompanied by such extensive secondary infection that removal is impossible.

When, however, a growth is freely movable, and the enlargement of the glands does not extend too deeply, removal is certainly indicated, since, even if recurrence occur, life will be prolonged for a longer time than after simple gastro-enterostomy. The operation presents two chief difficulties: (1) The cut ends of the stomach and of the duodenum are of such a different size that union between the two is very difficult, and there is always a considerable risk of extravasation at the point where the suturing of the stomach, necessary to reduce the size of the opening to that of the duodenum, joins the actual anastomosis. Moreover, if any amount of duodenum be removed with the growth, the remaining portion will only partially be surrounded by peritoneum. (2) Another difficulty lies in the fact that the duodenum is a fixed organ and the stomach a movable one, so they are not suitable for uniting together. To obviate the difficulty of uniting the small orifice of the duodenum to the large opening in the stomach, Kocher has recommended that the opening in the stomach should be completely closed with a double row of sutures, and that the end of the duodenum should then be implanted into the posterior surface of the stomach about 1 inch from the cut end. This, however,

is open to the objection of uniting a fixed to a movable viscus. A much more satisfactory method consists in completely closing the ends of the duodenum and of the stomach, and then doing a gastro-jejunostomy; this is shown in Fig. 74.

For my own part, I have reversed the order of procedure, and my practice in cases of suspected cancer of the pylorus is to perform an exploratory operation, and

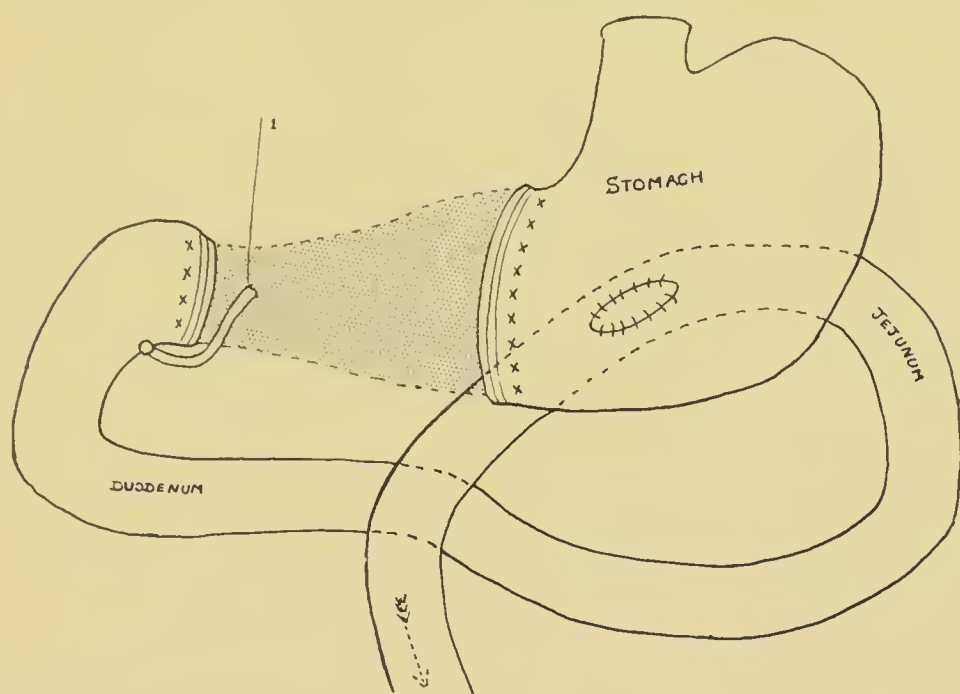


FIG. 74.—PYLORECTOMY COMBINED WITH GASTRO-ENTEROSTOMY.

1, Termination of common bile-duct.

after examining the growth and its connections, I then unite the jejunum to the stomach at some considerable distance from the pyloric growth. After the patient has recovered from this operation, the question of pylorectomy is discussed, and is urged if the growth is freely movable. A fortnight after the first operation the abdomen is reopened, and the pyloric tumour together with the glands are removed, and the ends of the stomach and duodenum closed with a double row of sutures. This

method of operating in two stages has many advantages. In the first place, it enables the patient to regain strength by taking food before submitting to the shock of the pylorotomy ; then the shock is less, as the duration of each operation is not considerable ; and as there is not so much need for hurry, the second operation is likely to be more thorough.

In five cases in which I have operated by this method the results have been satisfactory—all recovered from the operations, and lived for from one to three years after the operations.

CHAPTER V

SPECIAL OPERATIONS (*continued*)

Operations on the Large and Small Intestines

1. **Ileo-Colostomy.**—The ileum may be united either to the movable caput cæci, to the transverse colon, or to the sigmoid. The operation is required in cancer of the cæcum or colon, which does not admit of removal, in the case of an artificial anus of the small intestine or colon, in cases of volvulus of the sigmoid, and in some cases of ulcerative colitis.

In this operation care must be taken to select a loop of the ileum close to the cæcum ; this is found by passing the finger down to the cæcum, and picking up the nearest coil of small intestine. This should then be brought out of the wound, and the end nearer to the cæcum should be pulled upon till no more gut comes out, when it will be known that the last part of the ileum has been reached. The lower portion of the ileum can also be recognised by the absence of valvulæ conniventes in this portion. Looking out for these, which can be felt and seen through the intestinal wall, will obviate the risk of attaching the jejunum to the sigmoid. Having found out the lower part of the ileum, the coil is slackened so as to select a part about 6 or 7 inches from the cæcum ; this distance is necessary so as to avoid any dragging on the anastomosis. Care must also be taken to unite the ileum

to the colon or sigmoid in such a way that the wave of peristaltic contraction shall travel in the same direction on either side of the anastomosis.

The anastomosis may be performed either by lateral anastomosis or by implantation; in the former case either Halsted's method (*vide* p. 28), or the double

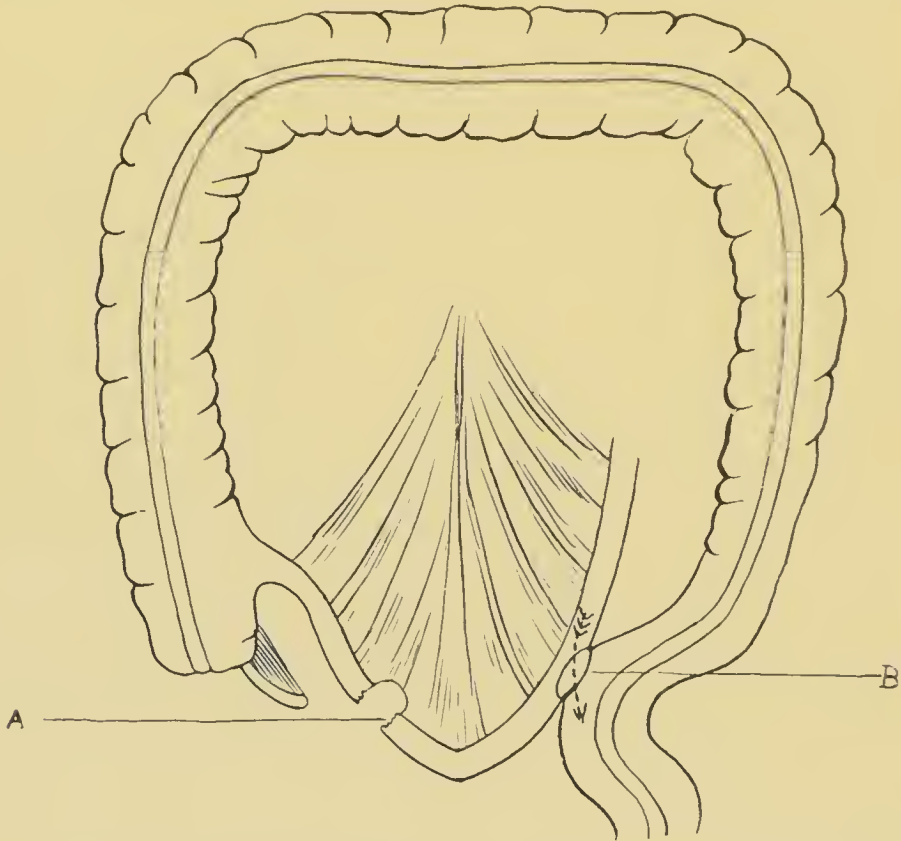


FIG. 75.—THE OPERATION OF ILEO-SIGMOIDOSTOMY.

A, Occlusion of ileum between the anastomosis and the cæcum; B, the anastomotic opening between the ileum and sigmoid.

continuous suture (*vide* p. 32) can be employed. I have personally used Halsted's method in nearly every case, and I am strongly in favour of it, especially when dealing with a distended ileum, since the sutures are all passed before the gut is opened, and extravasation is unlikely to occur. Bobbins and buttons are unsuitable for the operation for the reason pointed out before—

namely, that the opposite walls of the small intestine stretched over the bobbin prevents the passage of fæces through the anastomosis so long as they remain *in situ*. When a lateral anastomosis is performed for the cure of an artificial anus, or as part of an operation for the removal of a tumour of bowel, the small intestine on the distal side of the anastomosis will have to be divided and occluded as described on p. 27. When, however, the operation is performed for obstruction due to irremovable cancer no occlusion operation will be necessary.

The operation of implantation consists in division of the ileum at a few inches from the ileo-cæcal valve, and then making an opening (of a length corresponding to the diameter of the ileum) in the anterior surface of the colon or sigmoid. The proximal end of the ileum is then united to this opening either by a double row of continuous sutures or by Maunsell's method, which, however, necessitates another incision in the colon. The distal end of the ileum is then closed as described before. The disadvantages of implantation are (1) that it is difficult to prevent leakage at the mesenteric border of the ileum, and (2) that the opening is liable to contract, especially if the anastomosis be performed by continuous sutures.

The operation of ileo-colostomy is a very satisfactory one, and the mortality is small ; it is strange that patients do not suffer any ill-effects from having nearly the whole of their large intestine cut off.

After a few weeks the motions become quite formed, and there is no increased frequency in passage of them.

2. The Introduction of Paul's Tubes.—Paul's tubes are made of glass, and of two sizes—one for the small and the other for the large intestine. Their shape

is shown in Fig. 76 ; the groove at the lower edge is for the retaining suture to lie in, and prevents the tube from slipping into, or out of, the bowel.

The Operation of Enterostomy

It is very rarely necessary or desirable to make an artificial anus in the small intestine, since the distress occasioned by the continual passage of liquid fæces over the wound is almost intolerable. The operation may, however, sometimes be necessary as a temporary measure in cases of acute obstruction, when the patient is so

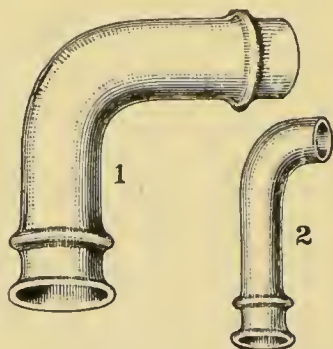


FIG. 76.—PAUL'S TUBES. (DOWN BROS.)

1, For large intestine ; 2, for small intestine.

collapsed that any search for the cause of the obstruction is out of the question. As a permanent measure it is occasionally called for in cases of extensive malignant disease of the pelvic region, where no anastomotic operation is possible. It is performed in the following way : A loop of distended intestine is brought out of the abdominal wound, and is compressed on each side by the fingers of an assistant or by clamps. A purse-string suture is then passed through all coats of the bowel round the place where it is proposed to make an opening. The opening is then made just the same length as the diameter of a small Paul's tube, which is immediately

slipped in, and the purse-string sutures tightened. Care must be taken to sponge away any escape of the intestinal contents. A rubber tube fixed to the end of the Paul's tube will prevent any further soiling of the wound. The operation is completed by passing a few points of Lembert's suture between the sides of the loop of intestine and the parietal peritoneum, after which the loop is allowed to fall back, and the rest of the abdominal wound is closed in the ordinary way. The Paul's tube will probably remain *in situ* for about

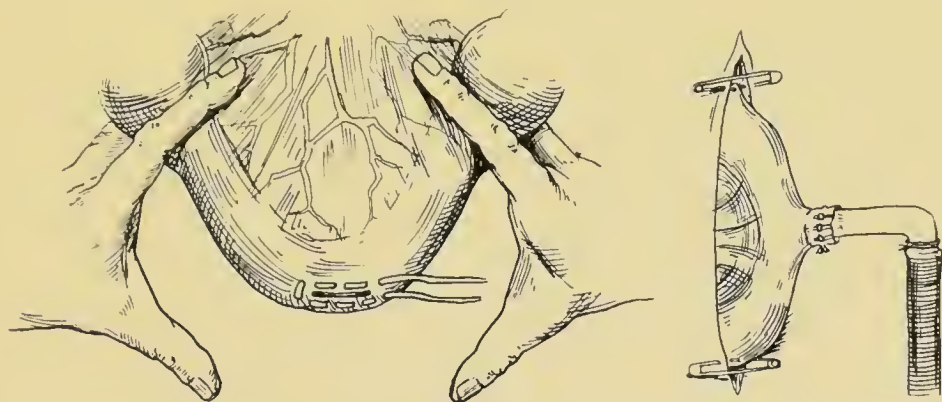


FIG. 77.—METHOD OF INTRODUCTION OF A PAUL'S TUBE IN ENTEROSTOMY. (CHEYNE.)

The right-hand figure shows the purse-string suture inserted before the bowel is opened ; the left-hand figure shows the tube tied on.

four days, when it will separate. By this time, however, the peritoneal adhesions are quite firm, and there is no risk of extravasation. The rest of the abdominal wound, too, is sufficiently healed that it will not be much irritated by the passage of fæces over it.

The Operation of Colotomy

This operation is now becoming much more limited in its use. It should, I think, be restricted to those cases of rectal obstruction which are incapable of removal, to cases of carcinoma at the lower end of the sigmoid,

where it is impossible either to remove the growth or to anastomose the ileum to the sigmoid below the growth, and to cases of inoperable malignant disease of the pelvic viscera.

It is, of course, sometimes performed as a temporary measure in the course of removal of a carcinoma of the colon or sigmoid.

No mention need be made of the lumbar operation, since it has practically fallen into disuse. The main points in the inguinal operation are (1) to prevent infection of the abdominal wall, (2) to form a proper spur, so that the intestinal contents do not go on past the opening. The first point is effected by deferring the opening of the bowel for a few days after attaching it to the skin, or by conducting the fæces away from the wound by means of a Paul's tube ; the second is brought about in a variety of ways—some surgeons pass a stitch through the mesosigmoid, and attach this to the abdominal wall, others pass a glass rod or piece of gauze through a hole in the mesosigmoid, etc.

I will, however, describe the method which I have devised, and which I have now employed for some years. It absolutely insures that no fæces can pass into the lower part of the sigmoid, since the gut is completely divided, and there is a bridge of skin between the two openings. The operation is performed as follows :

The incision in the abdominal wall is made in the usual position, but is slightly longer than in the other methods. After opening the peritoneal cavity, the loop of sigmoid is brought out of the wound, and a hole is torn in its mesosigmoid. The edges of the peritoneum on either side are then united together at the centre of the wound inside the hole of the mesosigmoid with two silk mattress sutures ; this is easily done by passing the

needle first through the parietal peritoneum on one side, then passing the needle through the hole in the mesosigmoid, and then picking up a portion of the opposite parietal peritoneum, and back through the hole in the mesosigmoid, and finally through the peritoneum close to the commencement of the suture. This is shown in Fig. 78. The second stitch is passed in a similar manner. Two silkworm-gut sutures are then inserted

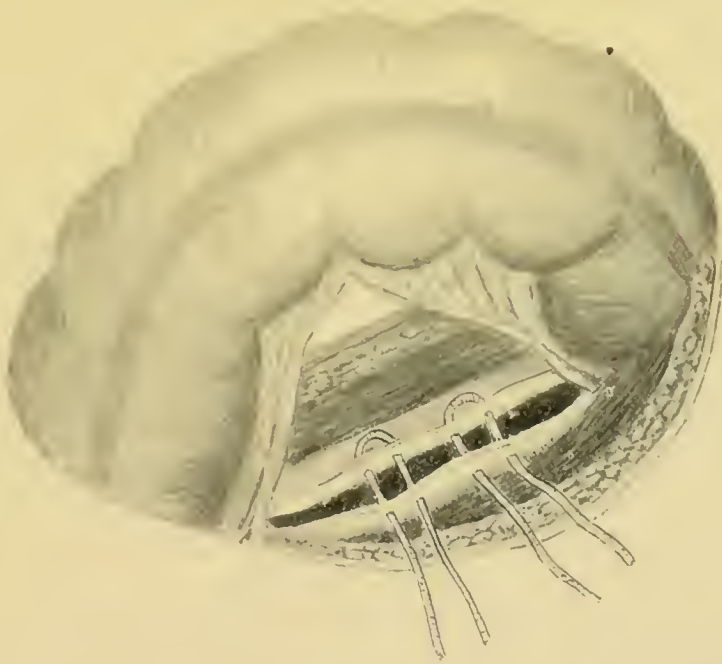


FIG. 78.—THE OPERATION OF COLOTOMY. (A. BALDWIN.)

The stitch has been passed to unite the peritoneum with the hole torn in the mesosigmoid.

to unite the corresponding portions of skin within the rent in the mesosigmoid. When these sutures are tied the centre of the wound is united within the hole of the mesosigmoid, and the loop of sigmoid is prevented from slipping back. The only further stitches which are necessary are one at each angle of the wound passed between the bowel and the skin to prevent any more bowel becoming prolapsed. If the operation is done for acute obstruction, it will be necessary to make

an opening into the bowel at once ; before this is done a stout silk ligature is passed through the hole in the mesosigmoid, and then an opening is made into the centre of the loop of intestine. A large-sized Paul's tube is then inserted into this opening, and the silk ligature is tied tightly round the flange of the tube, strangulating the whole of the circumference of the bowel and the vessels of the mesosigmoid. At the same time another stout silk ligature is passed through the hole in the meso-



FIG. 79.—COLOTOMY. (A. BALDWIN.)

The skin has been united within the hole torn in the mesosigmoid. The two stout silk ligatures passed round the sigmoid are used for tying in the Paul's tube.

sigmoid, and the distal end of the sigmoid is tied tightly with this, so as to strangulate it. The loop of gut between the ligature and the part where the glass tube is tied in will slough away at the end of a few days, and the tube will fall out, leaving the openings completely separated by a bridge of skin, and flush with the abdominal wall.

In chronic cases, where it is not desired to open the bowel at the time of the operation, the two stout ligatures are passed through the hole in the mesosigmoid, and the

ends knotted together separately. At the end of three days an opening is made in the convex surface of the loop of sigmoid, a Paul's tube inserted and tied in, and the distal end tied with its ligature as before described. In this way all risk of hæmorrhage is avoided, since the exposed part of the bowel sloughs off in the course of three or four days.

CHAPTER VI

SPECIAL OPERATIONS (*continued*)

I. Operations on Gangrenous Bowel caused by Strangulated Hernia or by Internal Strangulation

1. **Hernia.**—It is often difficult to determine whether the bowel is really gangrenous or not, and in case of doubt it is better simply to reduce the bowel very carefully, leave it near the opening, and drain the wound ; then if the bowel should give way no extravasation into the general peritoneal cavity will take place. Mere blackness of the gut does not mean gangrene, and in many such cases the gut recovers its function. The important points, however, are the absence of any shine in the peritoneal coat and the deposit of lymph about the neck of the sac. If, of course, there be any free gas, an offensive odour, or pus in the sac, there will be no doubt of the occurrence of gangrene, and something must be done. The operative procedure will depend a good deal on the condition of the patient. If the patient is much collapsed, it is best to simply make an opening in the gangrenous knuckle of bowel, and to pass a medium-sized rubber tube into the bowel above the strangulated portion. In this way the intestinal contents will pour out of this tube, and will not foul the wound. The tube is stitched to the skin incision, and the rest of the wound left open and packed with gauze. If the patient rallies from the

operation, you will then have to deal with an artificial anus, the treatment of which will be described later.

If, on the other hand, the patient's condition is good, an attempt may be made to do an immediate resection of the gangrenous portion of the intestine. To do this it is absolutely essential to open up the ring completely, and to make a free incision into the abdominal cavity. Before doing this the sac must be well cleansed with perchloride of mercury solution, and the ring must be very carefully divided from without inwards, as any introduction of a finger or even director into the ring might cause rupture of the gut. It is therefore better to make a free incision extending up from the sac, and to open the abdomen above the ring, and then to carefully divide this from above downwards and from without inwards. Very great care must be taken when the sac has been laid into the general peritoneal cavity to prevent any fouling of the peritoneum by gangrenous gut. The general cavity should be shut off with towels or large swabs before the gut is lifted up. The gangrenous knuckle is then brought outside the abdomen, and is clamped at least 6 inches above and below the strangulated portion. Another two pairs of clamps are applied close to the strangulated portion. It is very important to remove a considerable amount of bowel on each side of the strangulation, so as to insure that the portion which is joined is quite healthy, and has a proper blood-supply. About 3 inches on each side is the usual amount. The management of the mesentery will depend upon whether the mesenteric vessels are thrombosed. If the vessels are thrombosed, a **V**-shaped piece of mesentery should be removed with the strangulated knuckle; if the mesenteric vessels are not thrombosed, the mesentery should be divided close to the bowel, and all vessels ligatured.

The piece of strangulated bowel and the apparently healthy gut on each side are then cut away together with its clamps. The ends of the gut are carefully cleaned with perchloride lotion, and can then be united either by interrupted sutures, by double continuous sutures over a bone bobbin, or by Maunsell's method. In cases where time is of moment a Murphy's button may be used. It must, however, be remembered that in cases of gangrenous herniæ there is sure to be a considerable amount of dilatation of the gut above the obstruction, and probably ulceration of its mucous membrane, so that the application of the button is not so easy, and there is a risk of the pressure of the foreign body aggravating the ulceration, and so leading to perforation.

2. Internal Strangulation. — In cases of internal strangulation when the gut is gangrenous, it is always necessary to bring the gangrenous knuckle of intestine outside the abdomen, and then the condition of the patient will decide on the method of treatment to be adopted. If the patient is collapsed an opening should be made into the gut just above the gangrene, and a small Paul's tube inserted in the same way as described for colotomy. It is unwise to remove the gangrenous gut, as this will separate of itself. The knuckle should be fixed to one angle of the incision by four or five sutures passing between the healthy gut, above and below the gangrene, and the parietal peritoneum; the rest of the wound is then closed, and the gangrenous knuckle dusted with iodoform. If the patient rallies from the operation the Paul's tube and the gangrenous gut will separate within three or four days, and then we shall have an artificial anus to deal with.

If the patient's condition is good when the gangrenous bowel is brought outside the abdomen it may be excised, and treated by end-to-end anastomosis.

In some cases of internal strangulation the bowel may become torn even when it is not gangrenous, and in these cases it is quite useless to suture the rent in the bowel. The whole constricted loop and healthy bowel on each side must be excised if the patient can stand the shock ; if not, the knuckle of gut must be stitched to the angle of the wound, and a Paul's tube tied in.

II. Operative Treatment of Intussusception

If the intussusception has existed for more than twelve hours it is very unlikely that it can be reduced without an operation, but an attempt may be made to reduce it by means of injection, if the case is seen very early. In using injections it must be remembered that the capacity of the colon in infants is not more than about 10 ounces, and in a child of three or four years it will be from 1 to 2 pints. In giving an injection, too, no force must be used, and it is better to give it entirely by gravity, using a funnel, which is raised only a few feet from the bed ; a syringe is not suitable, as it is difficult to control the force of the stream. The best fluid to use is milk-and-water, as this will become partially absorbed, and so diminish shock.

If the intussusception is not reduced immediately by these means the abdomen must be opened, preferably over the seat of the swelling. The intestines must be pushed on one side in order to obtain a view of the tumour, as this must be seen before any attempt is made to reduce it, since any reduction of a gangrenous intussusception would be certainly fatal. If the bowel appears fairly healthy, and there is no lymph about the neck of the intussusception, and so the parts may be considered not to be firmly adherent, an attempt should

be made to reduce the intussusception. The way to do this is to gently squeeze the portion of gut containing the apex of the intussusception, and to try and reduce this from below upwards. Great care is required not to cause damage to the walls of the gut, since it is not difficult to rupture the inflamed intestine if too much force be employed. On the other hand, some considerable amount of force is needed to reduce the œdema of the apex. The best way is to squeeze the whole tumour fairly firmly, and then to gently try to push it backwards. On no account must any attempt be made to reduce the intussusception by pulling on the intussusceptum, as this will certainly not succeed, and is a very dangerous proceeding, being often followed by rupture of the bowel. If the intussusception cannot be reduced by pressure and taxis the following methods may be employed : (1) An artificial anus may be made above the intussusception ; this, of course, would only be a temporary measure, and would require to be closed by a subsequent operation. (2) An anastomosis may be made between the portions of bowel coming to and going from the intussusception ; this would best be done by the Halsted's method for lateral anastomosis ; although it is a serious measure when a patient is collapsed, it is not so severe as the next one. (3) An incision may be made in the convex border of the sheath away from the mesentery, exposing the whole intussuscepted portion ; this is turned out of the incision, and is transfixed close to its neck by two needles armed with stout silk sutures. The intussusception is then cut away just beyond these two sutures, and bleeding-points in the mesentery are ligatured. When the intussusception is cut away the two sutures will be seen running across the lumen of the invaginated bowel ; these sutures are then picked up with a blunt hook, and each is divided

at its centre, leaving four sutures passed through all the coats of both pieces of intestine; this exactly resembles the procedure in Maunsell's operation. This is shown in Fig. 80. These sutures are tied, and a few more are

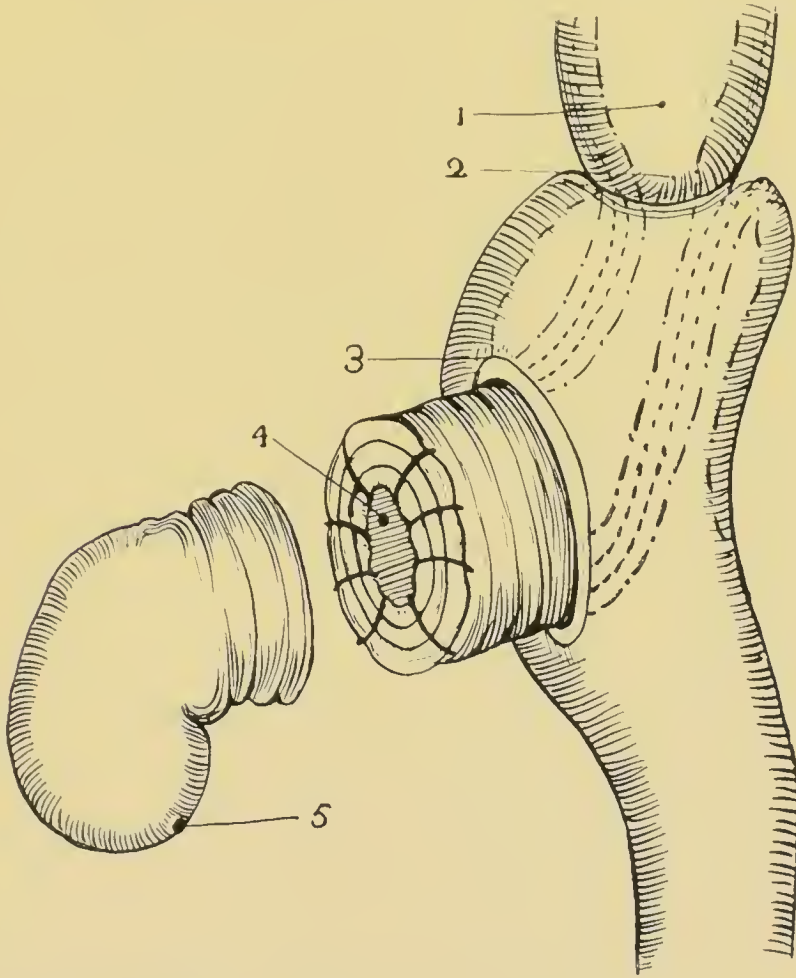


FIG. 80.—THE METHOD OF EXCISING AN INTUSSUSCEPTION THROUGH AN INCISION IN THE INTUSSUSCIPiens. (AFTER GREIG SMITH.)

1, Entering bowel; 2, neck of intussusception; 3, incision in intussusciens; 4, cut edge united with suture; 5, apex of intussusception excised.

inserted. The incision in the sheath of the intussusception is then closed with a row of Halsted's sutures, and a continuous Lembert's suture is inserted round the neck of the intussusception. The mortality of the operation is very great.

III. The Treatment of Artificial Anus or Fæcal Fistula

The difference between these two terms is rather vague. The term 'fæcal fistula' is sometimes applied to any communication between the small intestine and the abdominal wall, and the term 'artificial anus' confined to a similar condition of the large bowel. I think,

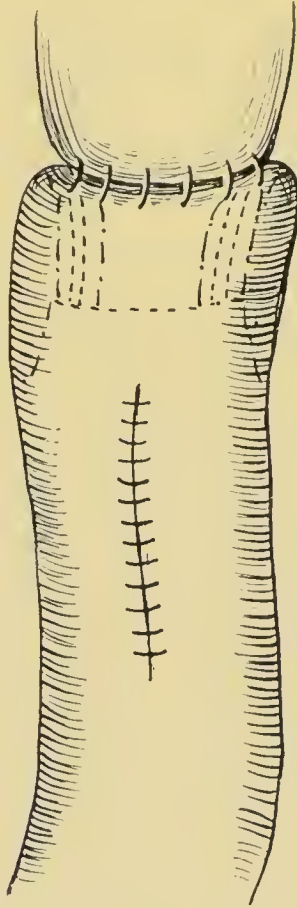


FIG. 81.—INCISION OF INTUSSUSCEPTION.

The operation completed.

however, that the term 'artificial anus' should apply to any intentional opening made into the bowel, whether large or small, and the term 'fæcal fistula' kept for communications which arise in consequence of ulceration or failure of suturing. There is a considerable amount of difference in treatment of an artificial anus in the small and large intestines.

I. Artificial Anus of Small Intestine.—This condition is of a serious nature, and urgently calls for some operative treatment, both on account of the distress caused by the continual passage of liquid motions from the wound, and also from the fact that patients rapidly emaciate when there is an artificial anus in the small intestine. Of course, this interference with nutrition will be more marked the higher up in the intestinal tract that the opening is situated.

There are three principal methods of dealing with an artificial anus :

(1) Resection of the whole opening, and an end-to-end anastomosis of the afferent and efferent portions of gut.

(2) A lateral anastomosis between the afferent and efferent portions of gut combined with occlusion of the afferent portion of the gut between the anastomosis and the artificial anus.

(3) The application of an enterotome, either Dupuytren's or Mickulicz's.

In any operation for the relief of this condition it must be remembered that, although the artificial anus was originally made by an opening only in the convex border of the gut, the loop of intestine will have been so much pulled on that there will probably have developed a well-marked spur, and the passage of fæces onwards past the artificial anus will be effectually prevented ; simple closure of the opening then will not be of any use. Secondly, it must be borne in mind that no operation is of use unless the channel is clear below the opening.

(1) In the first method referred to, the artificial anus should be well purified, and then plugged with gauze, and its edges sewn together with silkworm-gut sutures over the gauze plug. An incision is made all round the anus, and

continued above or below it for about 2 inches; the peritoneum opened at the extreme end of the incision, and the adherent knuckle of gut carefully freed from the abdominal wall. The part is then examined, and the amount of loss of substance of the wall of the gut is estimated, and also the amount of contraction which would be caused by suturing the wound left after dissecting out the artificial anus. This will usually be very considerable, and so such a method of treatment will be out of the question. It will therefore be necessary to do some resection. The bowel must be clamped above and below the artificial anus, leaving at least 3 inches of healthy bowel on each side between the clamps and the opening. The bowel is then divided on each side of and close to the artificial anus, and the knuckle of gut containing the artificial anus removed after tying the vessels in the mesentery. The two ends are then united by any of the methods described, such as Maunsell's, or over a bone bobbin.

(2) In the second method there is less disturbance of the parts, and less risk of fouling the peritoneal cavity, than in the former. The method consists in first purifying the artificial anus, and inserting a plug and sewing the mucous membrane over it, then making an incision into the abdomen about 1 inch to one side of the artificial anus, and opening the peritoneum. The loops of gut going to and coming from the artificial anus are then identified, and a lateral anastomosis is made between these about 3 inches from the opening. The lateral anastomosis is best made by Halsted's method. The afferent portion of gut between the anastomosis and the artificial anus is then occluded by dividing it as described on p. 27. It is not necessary to occlude the portion of the bowel on the distal side of the artificial

anus. In this operation a small sinus is left at the site of the artificial anus, which will continue to discharge a small amount of mucus for some time, but will not give rise to much trouble. It will contract to a pinhole in a short time.

(3) In the third method the spur formed between the afferent and efferent portions of gut is divided by means of an enterotome, and the opening is closed at a subsequent operation.

The best-known enterotomes are Dupuytren's and Mickulicz's. A third one has recently been invented by Carwardine, which is a combination of the two.

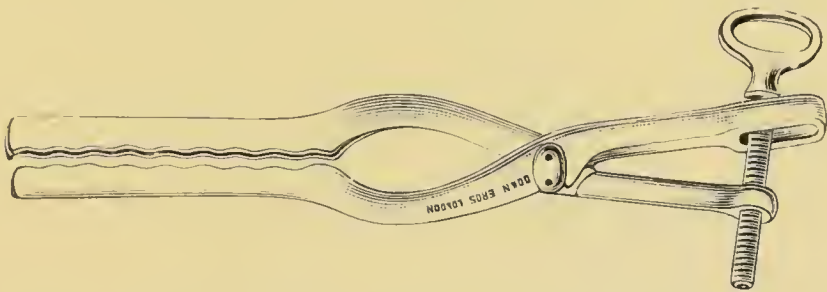


FIG. 82.—DUPUYTREN'S ENTEROTOME. (DOWN BROS.)

Dupuytren's enterotome is shown in Fig. 82. It consists of two blades which take apart, and each is introduced separately into the afferent and efferent portions of the gut, and are then united at their joint, and the blades are brought together by tightening the screw. This should be done very carefully, and at first only sufficient pressure should be employed to keep the enterotome in place. If more pressure is used the enterotome would cut through the coats of the bowel too quickly and extravasation would take place. The screw of the enterotome is tightened one half-turn every day, and the instrument will be found to have cut through by

the fifth or sixth day, by which time firm peritoneal adhesions will have formed. We shall then have a free channel between the afferent and efferent loops of intestine, and the larger amount of fæces will go by the proper channel past the artificial anus. It will, however, be necessary to complete the operation after an interval of a fortnight by closing the artificial anus. An incision is made around the edge of the artificial anus,

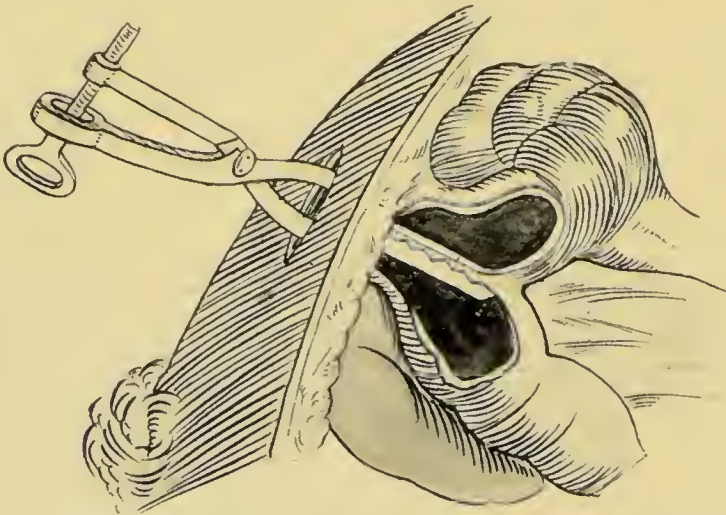


FIG. 83.—DUPUYTREN'S ENTEROTOME APPLIED AND DIVIDING THE SPUR.

and the mucous membrane is dissected up for about $\frac{1}{2}$ to $\frac{3}{4}$ inch all round. The edges of the mucous membrane are united by a row of sutures whose knots are inside the intestine, and by two or three rows of Lembert's stitches passed through the outer coats. Lastly, the edges of skin are brought together with sutures. The greater part of the suturing will probably hold, but often a small fæcal fistula is left, which, however, will gradually contract, and will not give rise to much trouble. Its closure may be hastened by touching it with a galvanic cautery.

Comparison of the Different Methods.—Much will depend upon the amount of adhesions which have formed around the artificial anus. Either of the first two methods may prove exceedingly difficult when adhesions are dense. In an ordinary case, however, I should be inclined to recommend the second operation, viz., the establishment of a new channel by a lateral anastomosis, as being the safest and the less likely to lead to any peritoneal infection. If, however, there is so much matting that the peritoneum cannot be opened by the incision 1 inch to the side of the artificial anus, then the first method of resection of the opening must be resorted to, but in this case any definite removal of a loop of gut will probably be impossible, and the artificial anus only will have to be excised. The objection to the resection operation is the risk of contamination of the peritoneum, the danger of subsequent stricture, or of failure of union of part of the anastomosis. The third method by the use of an enterotome is not to be recommended when dealing with the small intestine, since it is very difficult to avoid including only the mesenteric border of the gut, and the sloughing of this part may lead to dangerous hæmorrhage or extravasation.

2. Artificial Anus of Large Intestine.—This condition will occur after the removal of a growth of the large intestine, or after a colotomy for an irremovable growth, or for intestinal obstruction from other causes, such as volvulus of the sigmoid, or after ulceration of the cæcum in some cases of appendicitis. The distress occasioned will be greater the nearer the opening is to the cæcum, on account of the liquid nature of the fæces; an operation is all the more urgent when close to the cæcum. I am, however, strongly of opinion that an artificial anus should be closed in any case when it is

possible to get a sufficient length of healthy bowel below the seat of obstruction for the purpose of doing an anastomosis.

We need only consider two methods :

(1) The application of an enterotome, which is used in the same way as described for artificial anus of the small intestine ; this is more suitable for the large than for the small intestine, as it is more likely that a portion of the intestinal wall away from the mesentery (and therefore covered with peritoneum) will be included within the blades of the enterotome, and so no extravasation will take place. It is, however, only possible in cases of artificial anus left after removal of a growth where there is no obstruction beyond.

I only employ it in cases of removal of growth of the sigmoid flexure, where there is little room left below for the performance of a lateral anastomosis, and where there would be a risk of regurgitation of the fæcal contents through the artificial anus after such an anastomosis.

(2) By far the best method of closing an artificial anus of the colon, however, is the performance of an ileo-sigmoidostomy, and this operation is possible in any case where the obstruction is situated above the lower third of the sigmoid. The artificial anus is carefully plugged and sewn up as described above, then an incision is made along the outer border of the left rectus muscle, and the ileum found and united to the sigmoid, as described on p. 81.

When this operation is performed for the relief of an artificial anus it will always be necessary to occlude the ileum between the anastomosis and the cæcum, as described on p. 27. It will not be necessary to do anything to the artificial anus itself, as this will shrivel up, and nothing but a minute pin-point orifice will be left,

through which there is an occasional discharge of mucus. I have never had any troublesome discharge of fæces by regurgitation, except where the artificial anus was within an inch or so of the anastomosis. It is better not to attempt to absolutely close the end of the short-circuited large intestine, as there would be a danger of accumulation of mucus, and the risk of inflammation taking place in it.

IV. The Treatment of Cancer of the Colon

In acute obstruction the indication for operation is clear, and it is urgently called for to save life. In cases of suspected growth, where the symptoms are not at all acute, an exploratory operation should be performed.

In the first place, I should like to protest emphatically against the formation of an artificial anus except as a temporary measure. I have often witnessed the distressing condition of a patient after an artificial anus at the beginning of the colon, and I am inclined to think that death must be preferable to such a condition. The ideal operation, of course, is the removal of the growth, combined with an intestinal anastomosis; this is possible in the case of any growth which is not too firmly adherent to neighbouring parts. I have myself excised a growth of the transverse colon to which was adherent a coil of ileum and the bladder, and portions of both of these viscera had to be removed; and Pollard mentions a case where he had to excise a kidney which was infiltrated by a growth of the descending colon. Granted that the growth is sufficiently free to be removed, the simplest method, no doubt, is to excise it, and to unite the cut ends by an end-to-end anastomosis. There are, however, considerable objections to this procedure, since, except in the case of the sigmoid and the transverse colon, so much of the walls of the colon are uncovered by peri-

toneum, and, secondly, in the sigmoid, and often in the transverse colon, the intestinal contents are solid, so that there is a great strain on the stitches. These conditions have led me to abandon the end-to-end anastomosis after excision of the growth, and I prefer to re-establish the intestinal channel by means of a lateral anastomosis between the ileum and the colon. Formerly I was in favour of performing a lateral anastomosis first, and removing the growth by a secondary operation, but my experience with this method has not been fortunate, since in two cases of carcinoma of the cæcum in which I employed it the patients did very well after the ileo-colostomy, but, on attempting to remove the growth after an interval of fourteen days, the tumour was found to have contracted fresh adhesions, and the performance became much more difficult. In other cases so much relief was afforded by the ileo-colostomy that further operation was refused. I am therefore inclined to advise that in every case the loop of gut containing the tumour should first be removed, together with its mesocolon, the incision through the gut being at least an inch from the growth; the mesenteric vessels, too, should be divided some distance from the gut. To do this, the loop of gut containing the growth should be brought outside the abdominal incision, and after passing a circular purse-string suture through all the coats of the bowel, and picking up the mesocolon about $1\frac{1}{2}$ inches above the growth, an incision should be made in the convex border of the gut $\frac{1}{2}$ inch below the suture, and a Paul's tube slipped in and tied in position with the purse-string suture, which has the effect of stopping all bleeding; the gut is now completely divided below the Paul's tube, and the growth removed after clamping the end of the gut below the tumour. The cut end of the distal portion of the gut is then invaginated on itself and

closed with two layers of sutures, and dropped back into the abdominal cavity. The proximal end of the gut, with the Paul's tube *in situ*, is stitched to the parietal peritoneum by the insertion of three or four silk sutures.

If the patient is in a sufficiently good condition after this stage of the operation to stand another half-hour's anæsthetic, I immediately proceed to do a lateral anastomosis between the lower part of the ileum and the sigmoid, as described on p. 81. If the patient is suffering from shock after removal of the growth, the anastomosis may be deferred until a second operation, which should be performed about two or three weeks after the first. There is another way of re-establishing the intestinal canal after removal of the growth, which I have employed in two or three cases. After removing the loop of bowel outside the abdomen, a Paul's tube is stitched into each end of the gut below and above the growth, and the pieces of gut going to and coming from the artificial anus are united along their convex border by four or five silk sutures after the growth has been removed. When the abdominal wound has healed and the Paul's tubes have dropped out, a Dupuytren's or, better, a Mickulicz's enterotome is inserted, as described on p. 99.

Before passing on to the consideration of cases accompanied by acute obstruction, I would like to say one word with respect to prognosis. When an operation is performed in the early stages the shock is not great, and the risk of the operation is trifling; moreover, the ultimate prognosis after complete removal of the growth and its mesocolon is very good, and even when recurrence does occur this is usually delayed for some years. The absence of a large intestine after ileo-sigmoidostomy seems to exercise no bad effect upon the digestion or nutrition of the patient.

In operations for acute obstruction there is not usually much clue to the situation of the tumour, and so the incision should be made in the middle line in the first instance. When the patient is suffering from fæcal vomiting, some surgeons urge that general anæsthesia should not be employed, since several deaths have occurred from vomited matter entering the trachea, and so they advise operation under cocaine. I cannot, however, think it right to inflict the severe pain and considerable shock of an abdominal operation upon a patient who is already much weakened from the effect of obstruction, since even if the skin be anæsthetized by cocaine there is great pain and shock on handling the mesentery. My practice when fæcal vomiting is present is to pass a stomach-tube before administering the anæsthetic and wash out the stomach with warm water; this does not usually produce any collapse, but should it do so a little brandy and a hypodermic injection of strychnine may be given. With regard to the choice of chloroform or ether, although the latter is more stimulating, the former is distinctly preferable, since there is less chance of coughing and violent abdominal movement; nothing is so unpleasant when dealing with greatly distended intestine as the convulsive cough and straining often met with in patients under ether anæsthesia. The method of procedure in cases of acute obstruction is to open the abdomen in the middle line below the umbilicus; then, by introducing two fingers, the sigmoid can be explored to find if it is dilated. If dilated, it is followed down with the finger till the obstruction is felt. If this is movable, another incision should be made in the left inguinal region, and the growth brought out of the abdomen. Much assistance will be afforded by manipulating through both abdominal incisions; the growth should then be removed, and a Paul's tube tied in

as before described. In an acute case it is inadvisable to attempt any anastomosis operation until the bowels have recovered from the effect of the obstruction. Subsequently either an ileo-sigmoidostomy is done, or the intestinal canal is restored by the use of an enterotome. If the growth be immovable, and it be possible to pick up a loop of sigmoid below it, an ileo-sigmoidostomy should be performed at once and a drainage-tube tied into the anus, so as to insure escape of faecal contents. It is only when the growth is fixed in the pelvis and there is no free gut below it that a colotomy should be done ; it is an operation that is to be avoided if possible. When it is done, an opening should be made into the loop of bowel at the time and a Paul's tube tied in, since it is most important to relieve the obstruction at once, and if the faeces be conducted away from the wound by means of the Paul's tube no harm will result.

If the sigmoid be found to be empty, I turn immediately to the cæcum and examine this ; if the growth be not seated in the cæcum, by tracing the distended gut upwards the growth will be found. Wherever the growth is found and it is movable an incision should be made over it, and it should be treated in the same way as I have described for the sigmoid. After removal of the growth, and the patient has recovered from the effect of the obstruction, it is best to do an ileo-sigmoidostomy rather than to unite the ileum to the transverse colon or to attempt to restore the canal by means of an enterotome.

Anastomosis operations performed during acute obstruction have not the same freedom from risk as those performed during the quiescent period, and so should not be performed except in cases where the growth is not removable.

In cases where the growth of the cæcum or ascending colon is fixed, or there is infection of the peritoneum, I would not do a preliminary colotomy, as the distress occasioned to the patient by the passage of liquid fæces is too great, and in an incurable case the patient is not likely to submit to another abdominal section for the purpose of having an anastomosis done when the duration of life will be so short. I therefore think it right to subject the patient to the slightly extra risk of an ileo-sigmoidostomy at the time. This operation gives immediate relief, and in most of my cases a motion has been passed *per annum* within a few hours of the termination of the operation. Although, as I stated, the risk is greater in cases of acute obstruction than during the quiescent period, I do not think that it is much greater than colotomy under similar conditions. I have performed ten ileo-colostomies for acute obstruction, and of these eight recovered and two died. The cases that recovered had no further symptom of obstruction ; the ultimate result was not unsatisfactory, the patients living for three to eighteen months after the operation.

The points which I wish to lay stress on are : (1) That an early exploratory operation should be advised in any case presenting even vague symptoms of carcinoma of the colon ; (2) that the growth should be removed at once at the time of the exploratory operation, and that the re-establishment of the intestinal canal would be best effected by a lateral anastomosis between the ileum and sigmoid, which should either be done at the time or at an interval of a few weeks ; (3) that colotomy should never be performed except in cases of a growth fixed in the lower part of the sigmoid ; (4) that in any irremovable growth situated above the middle of the sigmoid flexure an ileo-sigmoidostomy should be performed instead of colotomy.

CHAPTER VII

OPERATIONS ON THE APPENDIX VERMIFORMIS

CONSIDERING the importance of the vermiform appendix in modern surgery, and the frequency with which the surgeon is called upon to deal with the organ, I have devoted a chapter to the measures which I consider should be employed in operations for trouble connected with the appendix. It does not, however, fall within the scope of this small handbook to discuss the pathology and etiology of, or indications for operation in, appendicitis, since these can all be obtained in text-books ; but I shall confine my remarks to the actual operations which require to be performed.

There are three conditions of the appendix which call for operation :

1. Acute general peritonitis due to fulminating appendicitis.

2. Abscess in connection with the appendix.

3. Recurrent attacks of slight appendicitis, the history of one severe attack, or persistent pain in the region of the appendix.

1. In acute general peritonitis due to fulminating appendicitis an operation must be performed with as little delay as possible. If the symptoms have started with pain in the appendix region, the abdomen should be opened by an incision one finger's breadth outside the

outer edge of the right rectus, and, after dividing the aponeurosis of the external oblique, the fibres of the internal oblique and of the transversalis muscle should be divided in the direction of the wound, and the peritoneum opened. Pus will then well out ; this should be washed away with sterilized saline solution, and the appendix searched for ; it will usually be found to be gangrenous or perforated. It must be gently lifted into the wound, and its mesentery ligatured. No time should be wasted in forming a cuff of peritoneum, but an incision should be made through the peritoneal coat round the appendix about $\frac{1}{2}$ inch from the cæcum, and the rest of the coats ligatured with a silk thread. The appendix is then clamped on the distal side of the ligature, and is cut off. A couple of Halsted's or Lembert's sutures are inserted close to the cæcum to invaginate the end of the appendix. A counter opening must now be made in the middle line above the pubes, and a very large drainage-tube inserted into the pelvis ; another drainage-tube is inserted into the first incision, and the abdomen is thoroughly flushed out with saline solution. A gauze-drain is inserted close to the drainage-tube in the lateral incision, and the rest of the wound closed with silkworm-gut sutures. The drainage-tubes should be sutured in position. The operation should be performed as rapidly as possible, and shock avoided by means mentioned on p. 136. Although the removal of the appendix increases the length of the operation and the shock, it is practically necessary, since recovery is unlikely if a gangrenous or perforated appendix be left behind.

If the symptoms of general peritonitis do not specially point to the appendix, the abdomen should be first opened in the middle line below the umbilicus, and then, on examination of the cæcal region, the appendix trouble

will be detected. It will be better to make a second incision over the appendix, and remove it through that, rather than attempt to do so through the median incision. The further procedure is the same as before stated. The prognosis is always very grave.

2. In cases of abscess in the region of the appendix, an operation will rarely be needed till between the sixth and twelfth day ; about the tenth day is the most usual. In these cases a definite swelling with dulness will be present ; and as it is most important to avoid opening the general peritoneal cavity, the incision should be made at a little distance within the edge of the dull area. If the dulness does not extend far forwards, the incision must be made as far back as the anterior superior crest of the ileum, but as a general rule the centre of the dull area is the best point.

The skin incision should be about 3 inches long, and the muscles must all be freely divided in the direction of the incision. When the fascia transversalis is divided, the peritoneum is exposed, but this is usually very much thickened, and often resembles bowel both in appearance and to the touch, and may cause one to hesitate before making an opening into it. It is, however, most important not to separate the peritoneum from the fascia transversalis outwards, so as to try to get behind it, as this opens up a cellular space where pus will afterwards burrow. It is better, if one feels any hesitation in opening the thickened peritoneum which presents in the wound, to puncture it first with an ordinary needle, when pus will well up out of the puncture, after which the surgeon need feel no hesitation in making a free opening with a scalpel. If it should happen to be gut which presents in the wound, the puncture with a needle will do no harm, and the pus will be found by separating the tissues outwards and

pushing the bowel inwards, and puncturing again. When the abscess cavity has been opened, it is much the wisest plan not to make any digital exploration of the cavity until it has been thoroughly flushed out. It is best to insert two large-sized tubes as far as they will go, and then to gently wash away the pus with a weak perchloride solution, or with izal, the fluid being introduced from an irrigator only a foot or so above the wound, and carried to the bottom of one of the drainage-tubes by means of a small rubber catheter ; in this way the cavity is flushed out from within outwards, and there is no danger of any adhesions being broken down. The abscess cavity should then be cautiously explored with the finger, and if the appendix can be felt it should be gently separated from its adhesions and brought out of the wound, when it is removed in the way described above. If it is not felt, no adhesions should be broken down to search for it. The two drainage-tubes are again introduced and the cavity irrigated in the way just described. The angles of the wound are closed with silkworm-gut sutures, and a gauze plug is introduced between the tubes, and the tubes themselves stitched in with gut sutures.

In cases of abscess, the less you interfere with the parts the better ; the essential thing is to let out the pus and promote free drainage. The prognosis is usually good.

3. Removal of the Appendix after an Acute Attack, or for Recurrent Slight Attacks.—In this operation we have no fear of peritoneal infection, and the chief danger to avoid is the occurrence of a hernia at the scar.

The incision is therefore of importance, and care should be taken not to divide any muscle across its long axis, but simply to separate its fibres.

There are two incisions which may be employed ; the first gives quite sufficient room in ordinary cases, but the

second gives more room, and should be employed when extensive adhesions are expected.

(1) An incision between 2 and 3 inches long is made two fingers' breadth outside the edge of the right rectus muscle, the centre of the incision being opposite the anterior superior iliac spine. The aponeurosis of the external oblique is divided in the direction of this incision ; the external oblique will then be exposed, its fibres running transversely to those of the external oblique and to the abdominal incision. The fascia covering the muscle is divided in one of the white lines indicating the separation between the bundles of fibres, and these bundles are separated in the direction of the fibres ; this will expose the aponeurosis of the transversalis muscle. The fibres of the internal oblique are forcibly held aside with retractors, and an incision in the same direction as the skin wound is made in the aponeurosis of the transversalis muscle, exposing the peritoneum. This is opened in the direction of the skin wound, and the cæcum will usually present in the wound ; this is shown in Fig. 84. Occasionally some adherent omentum is first seen, which must be ligatured. The cæcum should be brought outside the wound until its junction with the ileum is seen. On searching further downwards, the origin of the appendix will probably be discovered ; if not, the finger must be introduced into the abdomen, and passed in front, below, and outside the cæcum to search for the appendix. When it is found, it should be hooked up outside the wound, and recent adhesions separated with the finger.

If the appendix cannot be found, or when found cannot be brought out of the wound, it is best to pull out a few inches of the termination of the ileum, and by drawing on this the cæcum will usually be brought out of the wound ; this will probably expose the

appendix and facilitate its removal. When its mesentery is exposed, it is clamped with two or three pairs of artery forceps, and then divided between the appendix and the forceps. The clamped mesentery is ligatured with fine silk. The mesentery may also be dealt with as shown



FIG. 84.—INCISION THROUGH THE PARIETES IN APPENDECTOMY.
(A. BALDWIN.)

The fibres of the internal oblique muscle are separated by retraction and the cæcum exposed.

in Fig. 85, where only one ligature is applied close to the root of the appendix.

The appendix must now be dealt with. A circular incision is made round the appendix through the serous and muscular coats about $\frac{1}{2}$ inch from its junction with the cæcum ; the cuff so formed is reflected back nearly as far

as the cæcum, as shown in Fig. 86. The portion of the appendix denuded by the cuff is then crushed by the temporary application of a pair of artery forceps

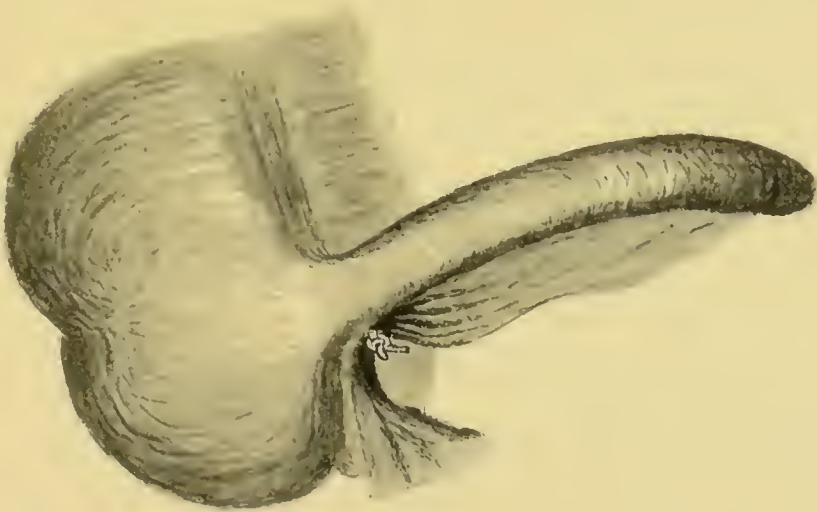


FIG. 85.—THE METHOD OF SECURING THE MESO-APPENDIX BY ONE LIGATURE AT THE ROOT OF THE APPENDIX. (A. BALDWIN.)

close to the reflection of the cuff, and the crushed portion is tied with a fine silk or catgut ligature; a



FIG. 86.—REMOVAL OF APPENDIX. (A. BALDWIN.)

Peritoneal cuff dissected back, muscular and mucous coats ligatured, and artery forceps applied beyond the ligature previous to removal.

clamp is then applied to the appendix just external to the ligature so as to prevent any escape of its contents, and the appendix is divided between the clamp and

the ligature and is taken away. The stump is touched with some pure carbolic acid applied with a small wisp of wool on a match, the end of the ligature is cut short, the cuff is brought forward, and two silk sutures are inserted to unite its edge. The stump now requires to be invaginated into the cæcum, and to do this two or three Lembert stitches are inserted into the cæcum $\frac{1}{4}$ inch from the edge of the appendix; when these are tied the appendix will be invaginated, as shown in Fig. 87. (N.B.—The suture nearest to the meso-appendix must be tied first.)

The appearance of the invaginated stump as seen in section through the cæcum is shown in Fig. 88.



FIG. 87.—REMOVAL OF APPENDIX. VIEW OF STUMP AFTER INVAGINATION. (A. BALDWIN.)

Some warm saline solution should now be run over the cæcum and the scar of the appendix, and the parts should be reduced into the abdominal cavity. The wound must now be very carefully closed.

In uniting the peritoneum, the omentum will often be found to give some trouble, as it has a great tendency to get in the way; I find, however, that this difficulty can be avoided by catching hold of the edges of the peritoneum at the two ends of the incision with four pairs of Spencer Wells forceps, and holding them up so as to

separate the peritoneum from the viscera. It will then be found easy to pass the stitches ; two or three mattress sutures of fine silk are then introduced and tied, as described on p. 121. The wound is then washed with some antiseptic solution, such as biniodide or perchloride of mercury solution, so as to counteract any infection which may have occurred during the removal of the appendix. The fibres of the internal oblique are united with a couple of silk sutures, and the aponeurosis of the

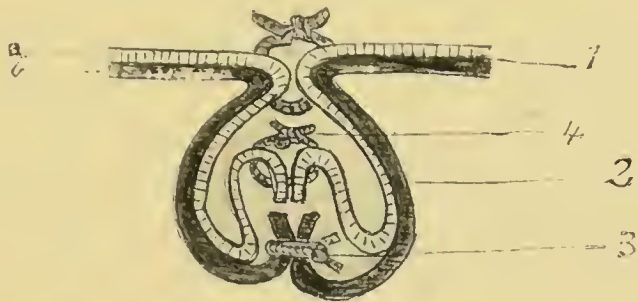


FIG. 88.—REMOVAL OF APPENDIX. DIAGRAM OF SECTION OF INVAGINATED STUMP. (A. BALDWIN.)

a, Serous coat ; b, muscular and mucous coats. 1, Wall of cæcum ; 2, invaginated stump of appendix ; 3, ligature round mucons and muscular coats of appendix ; 4, suture of peritoneal cuff of appendix.

external oblique with a row of silk sutures. The skin wound is closed in the ordinary way.

The special points to pay attention to in this operation are : (1) To make as small an incision as possible ; (2) to thoroughly divide all adhesions in the region of the cæcum ; (3) to remove the appendix quite close to the cæcum ; (4) to invaginate the stump within the cæcum ; (5) to prevent any infection of the wound during or after removal of the appendix—this is done by covering the wound and the cæcum with sterilized cloths while removing the appendix, and by throwing away any mop used for the cut mucous membrane, and by covering up

the stump as quickly as possible ; (6) to prevent any possibility of hernia at the scar.

The second incision, which may be employed when it is expected that the adhesions will be dense, is made along the outer border of the rectus muscle ; the linea semilunaris should be avoided, as it is more difficult to suture afterwards. An incision about 3 inches long is made one finger's breadth inside the right linea semilunaris, and the anterior sheath of the rectus is opened. The muscle is then either pushed inwards or some of its fibres separated, and an incision made in the posterior sheath of the rectus, exposing the peritoneum, which is then opened. In this way a very free opening can be made. The operation is proceeded with in the same way as described above. The wound is closed in the way described on p. 121.

CHAPTER VIII

INCISIONS INTO THE ABDOMEN, AND THE METHOD OF CLOSING THEM

THE choice of the position of an abdominal incision is of considerable importance. In the first place, except in the case of an exploratory laparotomy, it should be made as directly as possible over the organ on which it is desired to operate. In the case of an exploratory laparotomy, the incision should be near the middle line, either above or below the umbilicus, according as it is wished to explore the upper or lower part of the abdomen.

The next point is that the incision should be made in such a place and in such a way that there is no risk of subsequent hernia. The most important factors in preventing hernia are the avoidance of fibrous intermuscular spaces, such as the linea alba or the linea semilunaris, and the separation of the fibres of muscles instead of their division. For this reason the old incision in the middle line either above or below the umbilicus should be abandoned, since it is difficult to secure firm union of the fibrous septa ; this is more especially the case with incisions above the umbilicus, where even to unite the cut edge of the linea alba is very difficult, and hernia is a very frequent result.

In the place of the median incision, the skin should be incised about $\frac{3}{4}$ inch to one side, and Cheyne recommends

that to facilitate the accurate closure of the wound after the operation, the skin should be dissected off the rectus sheath for 1 inch on each side. The anterior sheath of the rectus is then incised along the whole length of the wound, and the fibres of the rectus muscle are then separated with the handle of a scalpel; of course, if a tendinous intersection occurs in the length of the wound, this will have to be divided with a scalpel. The fibres of the rectus are then held apart with retractors, and the posterior sheath of the rectus is exposed; this is divided slightly to one side of the incision in the anterior sheath, as shown in Fig. 89, and the peritoneum exposed. This is picked up with dissecting or rat's-tooth forceps, and an opening

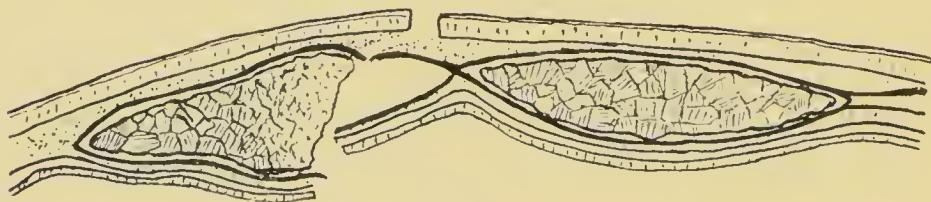


FIG. 89.—INCISION THROUGH RECTUS SHEATH, SHOWING THE DIVISION OF THE SKIN, ANTERIOR AND POSTERIOR SHEATH OF THE RECTUS IN DIFFERENT HORIZONTAL PLANES. (A BALDWIN.)

made in the portion picked up. In doing this, it is best to hold the scalpel in a lateral position, so as to avoid any risk of injuring the omentum or intestine. When a small opening has been made in the peritoneum, the edges are caught up with a couple of pairs of forceps, and these are held up in the wound so as to separate the peritoneum from the parts below. The peritoneum is then divided with scissors along the whole length of the wound. If the omentum is difficult to keep out of the way, a finger may be introduced through the wound to prevent the scissors injuring it. The use of a director is not to be encouraged.

In order to prevent the wound from becoming con-

taminated during an intestinal operation, it is advisable to tuck the end of a sterilized cloth inside the incision on each side ; this will effectually protect the cut edges.

The closure of the abdominal wound is of great importance, and the method of uniting all the structures of each edge with one row of silkworm-gut sutures should never be employed unless the patient is practically moribund. It is very doubtful whether the edges of the peritoneum were ever really brought in contact by this method. It is absolutely essential, in order to have a strong cicatrix, that each layer should be sutured separately. Some surgeons recommend catgut for the purpose, but I have always used silk, and I prefer it for two reasons—(1) it is more easily sterilized by boiling than other materials ; and (2) it is not readily absorbed, and so acts as a support to the abdominal wall for a considerable time after the wound has healed.

The best method of uniting the peritoneum is by means of Halsted's mattress sutures. Two artery forceps are applied to each edge of the peritoneum, and these are firmly held up, so as to separate the peritoneum from the viscera below, as is shown in Fig. 90. Mattress sutures are then inserted ; each suture is commenced $\frac{1}{4}$ inch from the edge of the peritoneum on one side of the wound, and then it is passed through the peritoneum of the opposite side of the wound $\frac{1}{4}$ inch from its edge, and finally returns through the two edges $\frac{1}{4}$ inch from its point of entry. The stitches should be $\frac{1}{4}$ inch apart, and the two threads of each stitch should be $\frac{1}{4}$ inch apart. In a small wound only three or four are necessary. When these are tied, they produce a considerable amount of eversion of the peritoneum, and insure a smooth line of scar within the abdomen. The method of holding up the edges of the peritoneum with catch forceps facilitates the

passing of these sutures very much. All the sutures should be passed before any are tied, and the forceps should only be released and taken off as the sutures are tied. When the peritoneum is shut off, the wound is sponged out with an antiseptic solution, such as biniodide

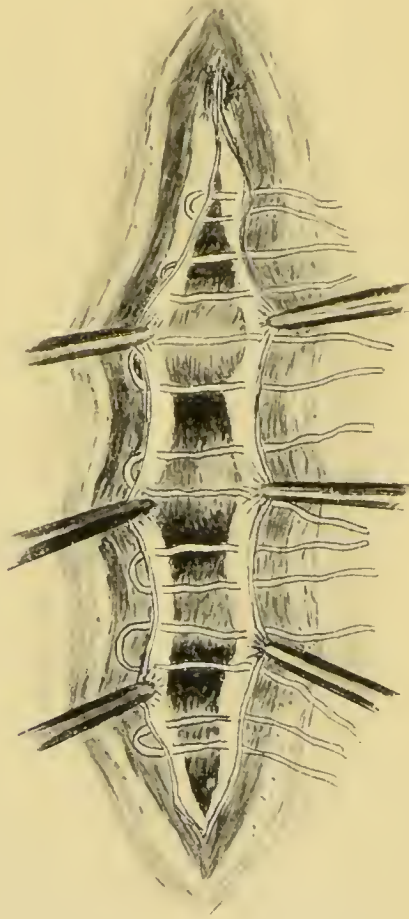


FIG. 90.—METHOD OF CLOSING THE PERITONEUM. (A. BALDWIN.)

The edges are held up with artery forceps. A row of mattress sutures have been passed.

of mercury, 1 in 2,000. The cut edges of the posterior sheath of the rectus are then united with a row of interrupted stitches, which are tied. No suture need be inserted between the separated fibres of the muscle, but its anterior sheath must be united with a row of interrupted sutures. Interrupted sutures are preferable to con-

tinuous sutures in the union of these layers of the sheath, as, if one thread of a continuous suture should ultimately cut out, the whole of the suture would become loose. In the same way, should any infection occur in the wound, it would remain local in the case of an interrupted suture, but would spread along the whole length of the wound in the case of a continuous one.

The skin incision should be accurately brought together with a few points of silkworm-gut suture, or a continuous suture may here be employed. The appearance of the wound when sutured is shown in Fig. 91. The wound is then dressed as described in Chapter X., p. 144.

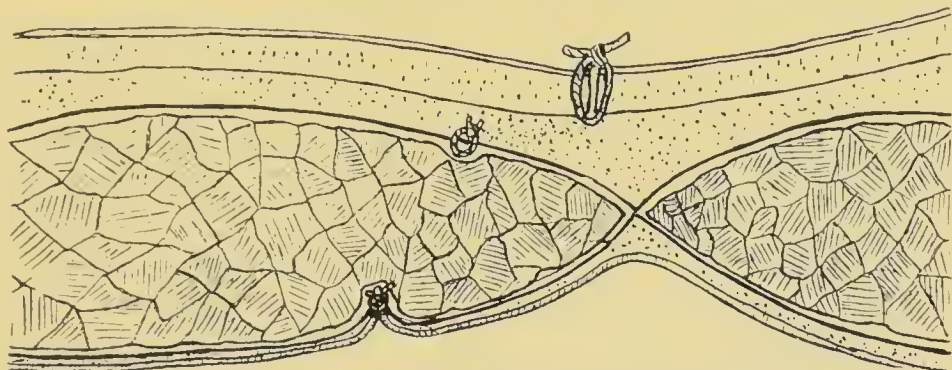


FIG. 91.—THE APPEARANCE OF AN INCISION THROUGH THE RECTUS SHEATH WHEN CLOSED. (A. BALDWIN.)

This is the general principle on which to make and to close an opening into the abdomen. In the case of an operation for the removal of a portion of intestine or of another organ, it is absolutely essential that the wound should be a free one, and in the case of cancer one must not hesitate to divide the muscles transversely, so as to get enough room, since insufficient room will probably mean incomplete removal of the disease. I have already referred to the necessity, in cases of abscess of the appendix, for the transverse division of muscle so as to insure proper drainage. The same indication will apply to other intra-abdominal abscesses, such as those in connection with the

liver, the gall-bladder, or the pancreas. In such cases the incision is made over the centre of the dull area, and the necessity for drainage, and for not disturbing any intra-peritoneal adhesions, is of more importance than the risk of hernia.

The position of the incision in cases of removal of the appendix has been described on p. 113.

The incision in cases of pylorectomy or pyloroplasty is best made about the centre of the right rectus muscle. This will expose the pylorus well.

The incision in cases of gastro-enterostomy, where there is no question of removal of the pylorus, should be made about the centre of the left rectus muscle, as this will allow easy access to the jejunum.

In cases of operation on the gall-bladder, the incision may be made 1 inch to the right of the middle line if it is intended to explore the ducts, and 1 inch to the inner side of the outer edge of the rectus if the gall-bladder alone is to be explored.

The incision in cases of ileo-sigmoidostomy should be made about $\frac{1}{2}$ inch inside the outer edge of the lower half of the left rectus muscle. This will give fairly good access to the sigmoid, which is the more fixed portion of gut. The lower end of the ileum can easily be brought out of this incision.

In all these incisions the rectus muscle is not divided ; only its fibres are separated, and the two layers of its sheath are divided in slightly different planes. When the incision is close to one edge, it is best to separate the fibres rather than to push the whole muscle either inwards or outwards.

After the operation the wound must be sutured in layers, as just described.

CHAPTER IX

THE PREPARATIONS BEFORE ABDOMINAL OPERATIONS

IN this chapter is included, not only the preparation of the patient, but also that of the operation room, of the instruments, sponges, etc., and, lastly, of the surgeon himself.

Abdominal operations at hospitals are now practically always done in the theatre, but in a private house some points in the selection of a suitable room are worthy of attention. It should be a large bright room, with a south aspect, capable of being well warmed and ventilated without placing the patient in a draught. A room which is not usually used as a bedroom is preferable to one in ordinary use. The floor should be covered with linoleum, and the walls, if possible, with a washing paper, the ceiling being whitewashed. All curtains, carpets, ornaments, pictures, etc., should be removed from the room some days before; it is better to remove wardrobes and chests of drawers, so as to avoid the risk of dust being created when these are opened. The floor, walls, paint-work, etc., should also be washed over with carbolic, if possible, two days before the operation.

If an operation has to be undertaken in a hurry, and the preparations cannot be made some hours before, it is better to omit moving any furniture, so as to avoid dis-

turbing the dust. Linen sheets should then be placed over the furniture. It is a great convenience to choose a room which communicates with another one, since not only is greater quietude insured by the nurse and servants entering another room, but it enables the washstand and other necessary articles of furniture to be removed. It is almost unnecessary to add that no food should be kept in the room.

The temperature of the room is of great importance, since it is very essential to prevent any unnecessary lowering of the patient's body-heat ; this is a most important factor in preventing shock. Between 75° and 80° F. is the best temperature during the operation. It is not pleasant for the surgeon and onlookers, but it is best for the patient.

The table on which the operation is to be performed also deserves notice. It should be 6 feet 6 inches long, and from 3 feet to 3 feet 4 inches in height, since a low table is fatiguing to the operator ; a special portable table is of advantage, especially if fitted with a mechanism to enable the Trendelenburg position to be maintained.

Over the table it is best to place a folded blanket for the patient to lie on, as a mattress is quite out of the question. It is unnecessary to add that the blanket must not have been used on a bed, but must be new, or obtained direct from the cleaners ; it should be covered by mackintosh sheeting and a sterilized sheet.

Two other tables are required at the operation, one for the surgeon's instruments, and one for the sponges and basins of antiseptic lotion. These tables at a hospital should be of enamelled iron with glass tops, and in private should be prepared by being scrubbed all over, first with soap and water, and afterwards with 1 in 20 carbolic solution ; the tops of each should be covered with a

mackintosh, over which is placed a sterilized towel. Some provision is also to be made for the apparatus of the anæsthetist, but this does not call for special preparation.

Arrangement of the Operation Room.—As before stated, every unnecessary article of furniture should be taken out, and the bed should be put in a part of the room furthest away from where the operation table is placed. The table should stand with its foot 3 or 4 feet from the window, and should never be placed sideways or parallel to the window, since a side-light is useless in abdominal surgery. The surgeon stands on the right side of the patient, and his table is at his right hand, so that a required instrument can be reached with the right hand without stretching over the left. The chief assistant stands opposite to the surgeon, and the table for sponges and lotions is placed just behind and to his left, so that he can easily reach the bowl of sponges. When two assistants are required the second stands at the operator's left. The anæsthetist stands or sits at the head of the table.

About six good-sized bowls are required for an operation; they should be of glass, porcelain, or enamelled iron, and must be properly prepared before use. The mere rinsing them with 1 in 20 carbolic solution is quite inefficient, since the solution will not remove caked dirt, blood or pus; they should be boiled and scrubbed. On the surgeon's table one or two bowls or trays should be prepared for the instruments, one for the ligatures and sutures, and another for an antiseptic solution for the surgeon's hands. On the other table one bowl should contain antiseptic solution for the assistant's hands, and the others should contain the sponges and sterilized saline solution for washing them out.

A considerable number of towels are required to

surround the seat of operation, and when possible these should be sterilized by steam, since mere soaking in 1 in 20 carbolic solution is not sufficient to render them sterile. A simple way of sterilizing is to boil them in a potato-steamer for twenty minutes, and then place them in 1 in 40 carbolic acid solution. Care must be taken to unfold the towels before sterilizing, otherwise the folded part will not get affected by the steam.

In the preparation of instruments, boiling is now universally employed ; if no special apparatus is at hand, an ordinary saucepan will answer. There are two points to pay attention to in boiling instruments. The first is to let the water boil for some minutes before introducing the instruments, so as to drive off all the air ; and the second, to add some ordinary washing-soda (in the proportion of a teaspoonful to a pint) to the water. These two precautions will prevent the instruments from becoming rusty by boiling. There is some difference of opinion as to whether knives should be boiled, since it undoubtedly affects the cutting edge ; the injurious effect can be reduced to a minimum by wrapping the knife in cotton-wool. Needles should always be boiled, since it is very difficult otherwise to sterilize their eyes ; they should be inserted in a piece of lint before boiling.

After sterilization by heat, the instruments may either be placed in the tray ready for use, or if prepared at home, for an operation at a patient's house, they should be placed in a sterilized metal case, or in a sterilized stout linen or holland bag to be carried to the operation. I have some envelope-shaped bags made which answer the purpose well ; they are sterilized before use and kept in an air-tight box.

Most surgeons prefer to put their instruments before use into some antiseptic solution, a weak carbolic solution

being most popular. Personally, I prefer a 1 in 60 carbolic solution ; nothing stronger than this should be used, since the peritoneum would be injured by introducing even a small amount of strong carbolic lotion. To absolutely prevent injury to the peritoneum, some surgeons use their instruments dry, or put them in sterilized normal saline solution ; the latter method is of course, ideal, but does not prevent the growth of any bacteria which may fall into it, or have settled on the instruments. Dry instruments are inconvenient when they have once been used, since blood will become clotted on them.

Sponges.—The preparation of sponges, or of the materials to be used in their place, is of prime importance. For intra-abdominal work it is necessary to use some material the particles of which will not be left behind in the abdominal cavity ; thus, ordinary cotton-wool made into swabs should never be employed. Marine sponges, if properly prepared, are excellent, but so also are sponge-cloths, or wool swabs wrapped and tied up in gauze, both of which must be sterilized by heat before use. The thorough preparation of sponges is of so much importance that in serious cases it should be undertaken by the surgeon himself or by someone under his superintendence, and not entrusted to chance ; personally, I would never use the sponges prepared in a shop for an abdominal operation.

The sponge should first be carefully selected. It is best to have one or two large flat sponges to cover exposed viscera, two or three small flat ones to pack round the part, and, finally, six or a dozen round sponges for swabbing. They should be soft, of very fine texture, elastic, and compressible.

There are several methods of preparing them ; I shall refer to three.

In the first method the sponges are freed from sand by frequent washing in water, then placed in water which is changed twice daily for a week. They are then placed in a dilute solution of hydrochloric acid, in which they remain for three or four days ; this dissolves out the remainder of sand and shell. They are then washed in frequent changes of water, and are placed in a strong solution of washing-soda for twenty-four hours ; this solution should contain 1 pound of washing soda for every twelve sponges. They are then washed in frequent changes of water, and either dried by heat or put in a glass jar containing 1 in 20 carbolic solution.

The second method is recommended by Lockwood. First thoroughly beat and shake the sponges to remove the sand, then soak for twenty-four hours in a solution of hydrochloric acid in water (1 drachm to the pint), which will remove bits of coral and shell. They are then washed in boiled water which has been allowed to cool to 100° F. in a covered vessel ; from this they are placed in a warm solution of washing-soda (1 drachm to 1 pint of water), and are allowed to remain for half an hour to remove fat and albumin ; they are then washed out in warm sterilized water, and put into a cold solution of sulphurous acid (1 in 5) for twelve hours. This insures sterilization and bleaching. A plate should be placed over the sponges to keep them at the bottom of the receptacle during bleaching, so as to prevent discolourization. They are then washed out in sterilized water, and squeezed as dry as possible, after which they are placed in 1 in 20 carbolic solution, and remain there until they are wanted. When required for intra-abdominal use, care should be taken to remove the carbolic acid, which is best effected by wringing the sponges out in sterilized saline solution.

The next method is Borham's method, and this is

specially recommended for cleaning sponges after use. The sponges, after removal of sand by washing, are soaked in a 1 per cent. solution of permanganate of potash, which is afterwards washed out by repeated washing and squeezing. They are then placed in a disinfecting fluid, which is prepared by dissolving $\frac{1}{2}$ pound of sodium hyposulphite in a gallon of water, and adding 4 ounces of oxalic acid; sulphur dioxide is then formed in the meshes of the sponges, and acts as a powerful disinfectant, as well as bleaching and removing fibrin. The sponges should not be allowed to remain longer than ten minutes in this solution, lest they should become rotten. They are then washed out thoroughly in several changes of water, and are either dried or put into 1 in 20 carbolic solution to remain till required. This method takes much less time than the former.

Another simple and usual method of cleaning sponges which have not been used for any septic cases is to first thoroughly wash out in plain water, then soak in several changes of soda solution for a couple of days, after which the soda is thoroughly washed out in water, and the sponges squeezed dry and put in 1 in 20 carbolic solution.

The use of marine sponges is all right in a hospital where a special set is kept for abdominal operations, or for a surgeon who is constantly doing this class of surgery; but, as shown above, their proper preparation requires a considerable amount of time and trouble; they therefore, probably, would not be available when wanted. For this reason, some more easily prepared material is preferable. Absorbent cotton material is now almost universally employed, and the great advantage of its use is that it can be sterilized by heat. Various forms can be used. Soft square sponge-cloths of an open texture, which can be obtained from an ordinary draper, are recommended by

some; these only require boiling for half an hour, and, when cool, they are wrung dry and placed in a weak perchloride solution or in sterilized normal saline solution. One of the easiest ways of preparing artificial sponges is from Gamgee tissue; this is cut into squares of three sizes—namely, 12 inches, 6 inches, and 3 inches; about six are required of each size. The edges of these squares are sewn over, so as to prevent any escape of the cotton-wool during use; they are then prepared for use by boiling. During an operation they can be used over and over again after washing them out in saline solution, in the same way as marine sponges. Another method is to wrap up round pledgets of cotton-wool in gauze, which is tied on; these are then sterilized by steam or by boiling. This method is not so handy as the use of Gamgee tissue, since the swabs take longer to make, and, moreover, they are not so good after they have been once used, as they cannot be washed out so easily.

Ligatures, etc.—Of even more importance than the preparation of sponges and instruments is the insurance of absolute asepsis in ligatures and sutures which are to remain in the wound. Here, again, I should never leave inside the abdomen a ligature or suture prepared at a shop, and I consider it only right to prepare them myself, or have them done under my own superintendence. The materials employed for ligatures and for sutures in abdominal surgery are silk, catgut, silkworm-gut, horse-hair, or even fine wire.

The best silk is that known as Chinese twist, and can be obtained in sizes ranging from 000 to 6; the two finest sizes are used for ligatures of small vessels and for intestinal sutures, No. 1 or 2 for sutures of the abdominal wall, and the larger sizes for ligatures of pedicles, etc.

The only reliable method of preparing silk is by boiling

for some considerable time, and it is also essential to unwind the silk before doing this, otherwise the central part of the hank would not be sterilized. It is best to wind a small amount on a small glass reel or on a glass microscopic slide, and so only sterilize about the quantity which will be needed for each operation ; there is always a certain risk in using a reel of silk for a second operation unless it be sterilized again, and with the finest silks boiling more than twice will probably make them rotten. I prefer to boil my silks for at least half an hour in Lister's strong antiseptic solution (a solution containing 1 in 20 carbolic acid and 1 in 1,000 of perchloride of mercury) ; they are then placed in 1 in 20 carbolic solution until required for use, when they are placed in a very dilute antiseptic if they are to be used for intra-abdominal work. The addition of some dye such as carmine or methyl blue to the solution when boiling is an advantage, as not only does it make the fine silk easier to distinguish, but it also in a way affords some indication as to whether the silk has been sufficiently sterilized, since if the silk has been wound too tightly, or has not been boiled for a sufficient time, it will be found that only the outer part of the reel has become dyed, and we may assume that the inner undyed portion of the silk has not been completely sterilized. Silk should never be boiled in soda solution with the instruments, since it is thereby rendered rotten. As ligatures may be weakened in preparation, it is important before beginning a continuous intestinal suture to test the strength of the silk. Horse-hair and silkworm gut do not require to be boiled before use ; prolonged soaking in 1 in 20 carbolic solution is all that is required.

With regard to catgut, although I seldom employ it in abdominal surgery, it is often used in intestinal anastomoses.

The following are the best methods of its preparation : The first is Esmarch's method, which consists in vigorously scrubbing ordinary commercial catgut with soft soap and a brush ; after washing in water it is wound on glass reels or slides, and then placed in a 1 in 100 solution of perchloride of mercury for twelve hours. It is then put in a 1 in 200 solution of perchloride of mercury in alcohol for another twelve hours, and preserved dry in closely-stoppered bottles. Before use it is laid in a solution of 1 in 2,000 of perchloride of mercury in alcohol. This method, according to Lockwood, produces sterile catgut.

The other method consists in the application of heat, and, since catgut cannot be boiled in water without being ruined, Mayo Robson has advised sterilization in xylol, which is kept at the temperature of boiling water for half an hour. A special metal cylinder with a screw top is required. The catgut is loosely wound on a reel or slide, and sufficient xylol is placed in the cylinder to cover the catgut ; the top is then screwed down, and the cylinder is placed in a saucepan of cold water, which is gradually brought up to the boil, and allowed to remain boiling for half an hour. The catgut is then removed and kept in alcohol. A similar method, using alcohol for xylol, has been recommended by Jellett.

The preparation of the patient may be considered under the two heads of general and local.

It has long been recognised that highly nervous patients are much more difficult not only to anæsthetize, but to treat after an operation. In the same way attempted suicides always give rise to much anxiety after an operation, and, as MacCormac has pointed out, wounded soldiers suffer more severely from shock after a defeat than they do after a victory. We must therefore admit that the nervous system has an influence on the

amount of shock after a serious operation ; in this way undue anxiety, or the fear of a fatal termination, creates an unfavourable condition, and should be combated by cheering up the patient, and by dispossessing him of the exaggerated fears of pain, sickness, or of death. In addition, it is best to keep the patient quiet in bed for a few days before the operation, with the nurse who is to look after him, so that he may become accustomed to her beforehand ; and finally, the friends, if anxious and indiscreet, should be kept away as much as possible.

According to Fertchenfeld, much relief is given in cases of special nervous apprehension by the administration of strophanthus ; 5- to 10-drop doses are given on the last two evenings before, and again on the morning of the operation. It is very important, too, that the patient should have a good night's rest before the operation, and should not be disturbed by any preparations. In cases of excitement, in order to insure sleep, either $\frac{1}{3}$ grain of morphia should be given hypodermically, or 20 grains of sulphonal may be administered twenty-four hours earlier.

Attention to the state of the bowels is important ; it has long been a nearly universal custom to thoroughly clear out the small and large intestine by means of a purge, followed by an enema the day before the operation. It is, however, doubtful whether it is always wise to do this just before a severe operation, especially if the patient be in a feeble state. My practice, if possible, is to give a purge, not on the evening before, but on the second evening before the operation, and that an enema only should be given a few hours before the arrival of the surgeon.

The great objection to the use of enemata is that they produce a drainage of the tissue fluids, which pre-

disposes to shock and limits absorption, metabolism, and excretion.

Under this heading, too, must be considered the question of trying to asepticize the intestinal canal by administering antiseptics by the mouth for some days previously. The antiseptics usually employed are salol or beta naphthol; the former can be given in 5-grain doses three or four times a day, and the latter in 3- to 5-grain doses in a cachet. Though these substances undoubtedly have the power of destroying a certain number of micro-organisms in the intestinal tract, yet they apparently disturb the normal assimilation of intestinal products, in which possibly bacteria play some rôle, so it is doubtful whether their exhibition is of any real practical use.

When, however, it is decided to employ them, they should be given three or four times a day for several days before the operation.

With regard to feeding before intestinal operations, a fair amount of food may be taken by the mouth up to the day of the operation, taking care, however, for the last twenty-four hours to give chiefly peptones and foods which leave little residue, together with alcohol or wine. It is not advisable to withhold food and give only nutrient enemata, but in an exhausted patient it is desirable to administer, shortly before the operation, an enema containing some peptone, and also $\frac{1}{2}$ ounce of brandy, or a large saline enema.

The next points in the preparation of a patient are those directed towards diminishing the post-operative shock. But first among these is the prevention of unnecessary loss of heat. To accomplish this end the patient should be warmly clad, and in such a way that no large surface of the body is exposed during the

operation ; the ordinary pyjama sleeping-suits of flannel answer the purpose admirably, since the chest, limbs, and the lower part of the abdomen can be kept covered, while the upper part is exposed. In female patients flannel drawers, reaching as low as possible, and woollen stockings may take the place of the trousers, but the jacket can be used by both sexes. I may here remark that this clothing should always be of flannel, not of flannelette, since the latter material is of no use to keep in warmth. Some surgeons have the extremities bandaged after being wrapped in cotton-wool, but this is not necessary. Greig Smith advised an ingenious device to prevent exposure during the operation. An ordinary blanket is torn in horizontal slips on each side, after the fashion of a many-tailed bandage, and is placed under the patient ; the tails are crossed over the whole of the patient's body and legs, only leaving exposed the area to be operated on. The blanket, of course, is afterwards covered with mackintosh and sterilized towels.

The next method of preventing shock is by the introduction of artificial serum, which is better known as normal saline solution. The simplest way of making this is by adding common salt to tepid boiled water in the proportion of one and a half teaspoonfuls to a pint. It can be introduced into the system in three ways : First, by intravenous injection, preferably into the median basilic vein (the mode most usually employed in this country) ; secondly, by subcutaneous injection, the fluid being forced by means of a glass syringe into the loose subcutaneous tissues in the region of the axilla ; and, thirdly, by means of small enemata frequently repeated. Either of these methods answers, but the last-named is likely to produce some irritability of the rectum and subsequent discomfort. The subcutaneous method

is certainly the easiest and quickest to perform, but the intravenous infusion produces the most rapid effect. Whichever method is employed, from 2 to 4 pints will have to be injected.

Stewart Lewis insists on what he calls the saturation method in the management of laparotomy in the place of the older methods, which had the effect of depriving the system of water (by purges, etc.), and so stimulating the absorptive power of the peritoneum. He points out that a certain amount of drainage of tissue fluids is an unavoidable evil in laparotomy, being produced by preliminary purgation, by keeping the stomach empty to avoid ether vomiting, and, thirdly, by loss of blood. This drainage should be limited in every possible way. In the preparation of his patients, while emptying and asepticizing the intestinal canal, he insists that the tissues should be fluid saturated to the physiological limit. The diet should be limited to that which will produce the minimum of both gas and toxins. Intestinal antiseptics should be employed, and several mild purgatives should be given instead of one, which is either imperfect or excessive and exhausting. Two or three grains of calomel, combined with some cholagogue, should be given eighteen hours before, and six hours before the operation 4 quarts of normal saline should be injected into the rectum very slowly, to insure long retention. For forty-eight hours before the operation copious draughts of water are given, 6 to 8 ounces being administered every two hours.

In order to lessen the post-operative shock and the tendency to paralytic dilatation of the intestine, several American surgeons have recently recommended that subcutaneous injections of ergot should be given before and after the operation. Ordinary ergot solution pro-

duces a good deal of irritation at the site of the injection, and therefore is not suitable, but an aseptic non-irritating fluid extract called ergone, which is made by Parke, Davis and Co., is of the same strength as the fluid extract, and is very suitable. It is recommended to give 30 minims hypodermically twenty-four hours before the operation, and to repeat the dose every eight hours for three days. The advantages claimed for the use of this drug are: (1) There is less post-operative nausea and vomiting and general shock; (2) tympanites does not occur, as the ergot causes contraction of the involuntary fibres of the intestine; (3) it relieves pain almost as efficiently as morphia, or if pain be not relieved a very small dose of morphia will be efficacious—it, moreover, produces a nerve calmness; (4) the bowels are opened with greater ease in cases where ergot has been given, in some cases no aperient being necessary.

The method seems worthy of consideration, especially as it is devoid of risk.

It only now remains to speak of the employment of morphia hypodermically, either alone or combined with atropine, or the latter drug alone. The use of atropine, I believe, is harmless, but I do not think that a preliminary injection of morphia is absolutely safe, although it certainly enables the patient to be kept unconscious with a smaller amount of anæsthetic; the ultimate shock, however, will be greater.

The preparation of the skin demands the utmost attention, especially where portions of the intestine may accidentally rest outside the wound in such operations as posterior gastro-enterostomy and other anastomoses. There are many modifications in the method of preparing the skin, the object of each being to render it as nearly aseptic as possible. The asepsis of the skin will not in

most cases be absolute, since bacteria are lodged in the deepest parts of sebaceous glands, and it is practically impossible to be certain of clearing these out. Therefore, after the most elaborate preparation, the skin must still be regarded as a source of danger, and should be kept covered up with sterilized towels, so that no internal organ or ligature touches it. The routine which I employ is as follows: Twenty-four hours before the operation the skin of the whole abdomen is scrubbed with soap and water, and if the patient be a hairy man the part of the abdomen to be opened is shaved. After this the skin is again scrubbed with a flesh-brush and soap; this is washed off, and turpentine is rubbed in. Lastly, carbolic acid solution, 1 in 20, is applied with a flesh-brush; a sterilized towel, soaked in 1 in 40 carbolic solution, is put over the prepared part and covered with a piece of jaconet, and kept in position with a many-tailed bandage. Immediately before the operation the skin is again scrubbed with soap and water, then with 1 in 20 carbolic, and, lastly, with some 1 in 1,000 perchloride of mercury. The brush should not be used for any other purpose, but should be kept for this alone; it should previously have been sterilized by boiling, or by having been kept in 1 in 20 carbolic acid solution for twenty-four hours. With regard to soap, either ordinary yellow or soft soap may be used; personally, I prefer an ethereal solution of soap, since the ether enables the soap to penetrate more deeply into the sebaceous glands. The removal of fat may also be effected by ether, benzine, alcohol, or turpentine; the latter is preferable, since it possesses a slight antiseptic action.

Some surgeons are not content with such preparations, and recommend more extensive ones. Thus Giulot directs that the abdominal wall should be treated for

three successive days by brushing with boiled water and soap, followed by alcohol and ether; after this an antiseptic dressing is to be applied until the following day. He also advises that the umbilicus should be thoroughly swabbed with tincture of iodine. Jessett recommends that the skin of the abdomen should be scrubbed twice a day for two days with a 10 per cent. solution of liquor potassæ, and a pad soaked in 1 in 3,000 sublimate solution applied after each cleansing.

Finally, we must not forget the hygiene of the mouth, since a septic condition of this part may affect a wound of the stomach or intestine, by the swallowing of pus with saliva. Not only should carious, useless teeth be removed or stopped, and the teeth carefully cleaned with antiseptic tooth-powder twice a day, but an antiseptic mouth-wash should be employed each time after taking food. The best washes for this purpose are a 5 per cent. solution of peroxide of hydrogen, a 1 in 80 solution of carbolic acid, or a solution of boric acid.

Attention has recently been drawn to this subject of oral sepsis by Dr. William Hunter,* who considers that if it be neglected it will produce septic gastritis by the swallowing of pus from the mouth. He points out that though the hydrochloric acid in healthy gastric juice has the power of destroying the micro-organisms which have been swallowed, this power is lost when, as in chronic gastritis, the hydrochloric acid is diminished in quantity, and even in health the power is feeble in the interval between meals.

Lastly, we have to consider the preparations to be made by the surgeon himself; we may consider these, too, under the headings of general and local. The general preparation includes a healthy mode of life, with some exercise

* *Clinical Journal*, September 12, 1900.

in the fresh air, and avoidance of fatigue, either mental or bodily. Treves specially denounces the practice of carrying a heavy bag just before an operation, and also advises strengthening the muscles of the arm by dumbbells, etc.

The clothing of the surgeon is of importance ; his arms should be bared by rolling up his sleeves, and his outdoor clothes should be completely covered by an overall, made of linen, which is sterilized by heat. If this is not at hand, an ordinary large sterilized bath-towel should be used.

The main preparation of the surgeon, of course, concerns his hands and arms, and too much care cannot be directed to these. The method of disinfection of the hands varies with different surgeons. The method I adopt is to scrub the hands and arms with a flesh-brush and ordinary yellow soap ; after this the hands, and especially the nails, are cleansed with an antiseptic ethereal solution of soap. The washing should take at least five minutes ; after this the hands are soaked for another three or five minutes in a 1 in 1,000 solution of perchloride of mercury.

With regard to the nails, most of the writers on aseptic surgery recommend them to be trimmed as short as possible. I do not, however, think that this is desirable, since the sensitiveness of the finger-ends is diminished by having the nails too short. I consider that they should be about $\frac{1}{16}$ inch long ; when not longer than this, there is no difficulty in cleansing them with ethereal soap. The best plan is, after cleaning them with a knife or other special cleaner, to wash the hands with soap and water for some time, and then to again remove any loose or sodden epithelium from under the nails with a cleaner. The disinfection is completed by scrubbing with ethereal soap and water.

Owing to the difficulty in rendering the hands sterile, several surgeons have recommended and used gloves during operations. These gloves in aseptic cases are of rubber, cotton, or fine silk ; they are sterilized before use by boiling, and are soaked in antiseptic solution after being put on. In septic cases indiarubber gloves must be used, and, personally, I reserve their use for such cases, since the interference with the acuteness of the sense of touch in the fingers will not insure the rapid performance of an intestinal suture, and in passing stitches according to Halsted's method, when the needle is pushed in by the pulp of the index-finger, the end of the needle would probably constantly catch in the gloves.

CHAPTER X

TREATMENT AFTER ABDOMINAL OPERATIONS

THE first point of importance in the treatment after abdominal operations is the dressing. I do not propose to discuss the various forms of antiseptic dressing ; suffice it to say that it is necessary to apply a dressing which is sterile, absorbent, non-irritating, and impregnated with some chemical which prevents the growth of micro-organisms. I think that Lister's double cyanide gauze answers these requirements. As supplied from the manufacturer, however, it may not be sterile, and so it is advisable to sterilize it by heat, or to keep it damped with 1 in 20 carbolic lotion ; this also has the advantage of removing any free sublimate which may be in the dressing, and which, if allowed to remain, might cause irritation of the skin. In abdominal surgery I always fix the dressing next to the wound by means of collodion, in order not only to avoid the necessity of bandaging tightly the chest and the upper part of the abdomen, but also to diminish the amount of dressings necessary. Without its use, too, the wound may become infected by micro-organisms which have crept under the margins of the dressings. After the edges of the wound have been accurately adapted with sutures, the surrounding part is finally cleansed with 1 in 1,000 perchloride solution, and a strip of gauze of six or eight thicknesses

and about 1 inch wide is wrung out in 1 in 40 carbolic, and applied to the wound ; the surrounding skin is then carefully dried with dry cyanide gauze, and a piece of dry gauze, of one thickness only, and about 3 inches wider than the moist dressing, is put over the wound and surrounding skin. This is fixed to the skin by brushing on collodion, which is dried by fanning. Ordinary collodion is far preferable to the flexible variety ; it dries more quickly, and is less liable to become loosened. When the collodion is dry, several thicknesses of dry gauze are placed over the wound and the area some distance round it, and over this some ordinary absorbent wool, or a layer of Gamgee tissue, is applied. The dressing is kept in place by a many-tailed bandage, which should be made, not of one piece of flannel with its sides torn into horizontal strips, but of six or eight strips of flannel, each 5 or 6 inches wide, and sewn together at the back in such a way that each strip overlaps the other for one-half its width. It should also be made to fit, care being taken that the tails are neither too long nor too short ; the simplest way to gauge the necessary length of the tails is to measure round the most prominent part of the abdomen, and to make the tails 12 to 18 inches longer than the girth. It should also be made the right width from above downwards ; the first tail should encircle the pelvis, and the last tail the chest. The best materials for it are either ordinary flannel or a very thin variety known as nun's veiling. The ordinary flannel is the best in the winter, and the nun's veiling is certainly more comfortable in hot weather. There is no objection to the many-tailed bandage being loosened and the cotton-wool readjusted, to make the patient more comfortable, even on the day after the operation, since the fixing of the dressing with collodion prevents any risk of the wound being infected during the process. The

dressing next the wound is left undisturbed for ten days, when it is removed, and the stitches are taken out ; a similar dressing is then reapplied for another week.

The next point is the management of the patient after the anæsthetic, particularly with a view to diminish shock, and to prevent, as far as possible, that persistent post-anæsthetic sickness which is a complication fraught with especial risk in stomach and intestinal surgery.

In the first place, care should be taken in moving the patient back into bed ; three people, all on one side, should lift the patient, one placing his arm under the thighs and buttocks, the second his arms under the back and shoulders, and the third supporting the head and looking after the arm opposite the lifters, so that it is not bent under the body. The bed should, if possible, be placed at right angles to, and close to the table, so as to diminish the distance over which the patient has to be carried. The patient should be carried perfectly horizontally, or with the head at a slightly lower level than the feet ; he should be slowly and carefully lowered on to the bed, and when this is entrusted to porters, care must be taken that the patient is never moved roughly, nor thrown down on the bed.

For use immediately after the operation, the bed should be made up with a low pillow or bolster, and the mattress should be covered first with a clean under-blanket, and then with a sheet and draw-sheet ; mackintosh under the sheet is not required, since it makes the bed less comfortable. Two good-sized pillows are placed under the patient's knees, and the patient is covered with a blanket ; over this a large cradle is placed to keep off the weight of the bedclothes from the abdomen, and then the ordinary bed-coverings are put on. The whole bed should be thoroughly warmed by a warming-pan, or, if this is not

obtainable, by several hot-water bottles placed inside at the commencement of the operation. Several fresh hot-water bottles also must be in readiness at the end of the operation, so that they can be placed at the patient's feet, and also at the side of his legs and body if any shock is present. These bottles must be covered with flannel, and placed outside the blanket covering the patient, and even then care must be taken that no part of the limbs remains in contact with them for any length of time, since burns very readily occur on the legs if hot-water bottles are allowed to touch these parts during recovery from anæsthesia. I have seen several cases where large portions of the skin of the legs sloughed, which necessitated many weary weeks of confinement to bed after the patient had completely recovered from the operation.

The patient must lie on his back, with the head low and turned to one side, so as to facilitate the escape of vomit ; he must not be left alone under any circumstances, since, in the nurse's absence, he might become choked by vomit, or might suffer from sudden syncope from an attempt to sit up while semiconscious. To prevent shock, the patient should have all wet clothing removed, and a dry, warmed flannel jacket applied, which can be done without causing any disturbance, but nothing which entails moving the patient should be put on till he has regained consciousness. After severe operation, the feet of the bed should be raised about 6 inches, so as to encourage the flow of blood to the brain. The patient should be rubbed down with a warm towel to remove the sweat, and also to encourage the circulation. The room should be warm, either 65° or 70° F., and no window should be allowed to be open.

As has been already stated, anæsthetic vomiting is particularly annoying in stomach and intestinal surgery, since

not only is a strain put upon the stitches, but the already half-starved patient is prevented from taking food. One method of preventing vomiting which seems to have a good result is as follows : Immediately after the inhalation of chloroform is discontinued, the patient is made to inhale about a drachm of vinegar from a towel. This very frequently has the effect of making the patient sick at the time, but I have certainly found that a considerable number of patients are free from vomiting afterwards ; I therefore think the method worthy of trial.

Nothing should be given by the mouth for four or five hours after the operation, but the patient should be allowed to rinse his mouth out with hot water at intervals.

According to Shuter, the duration and severity of the vomiting is influenced by the nature of the anæsthetic ; thus, although vomiting is constant after ether, the most prolonged cases usually follow chloroform. He notes, too, that the worst cases are in the prime of life, while old people often escape altogether, and children suffer slightly. Anæmic people suffer badly, and alcoholics slightly.

Various drugs have been recommended to prevent or control vomiting, but there is none which will act with certainty. Spencer gives his patients morphine and atropine every three hours to prevent vomiting, but other surgeons find that these drugs have the contrary effect ; cerium oxalate, bromidia, and small doses of hydrocyanic acid or of tinct. iodine have also been tried. Strong black coffee is very refreshing, and acts well in some cases. Ice by the mouth is of very little if of any value, and has a bad influence in needlessly abstracting heat from the body. When vomiting continues for more than twelve hours some other means will have to be employed. One of the best is to give the patient $\frac{1}{2}$ pint of hot water,

in which is dissolved from 15 to 20 grains of bicarbonate of soda. This often has the effect of making the patient sick, but at the same time enables him to bring up the mucus which is secreted by the irritated stomach. On the other hand, the hot water may not be returned, but may pass onward, and no more vomiting will occur. Strychnine, either by the mouth or hypodermically, is sometimes effective. In persistent vomiting also the bowels must be thoroughly cleared out. When, however, vomiting continues for two or three days, and the tongue becomes dry, more energetic treatment is indicated, and a soft stomach-tube should be passed, and the stomach washed out with several pints of boiled water, so as to remove all decomposing material. This must be repeated if necessary.

The position of the patient, too, after stomach operations has some influence on vomiting; thus, after the first few hours the patient should be propped up in bed with one or two pillows, and may also be turned on to the right side, so as to encourage the passage of fluids through the new pylorus.

Shock.—We have already referred in the treatment before operation to the methods which should be employed to prevent *shock*; and in this condition prevention is better than cure. When severe shock is present, the anæsthetic had better be diminished, and the patient kept scarcely under its influence. It may be better also, after the operation, to leave the patient for a time on the operating-table with the feet raised before removing him to bed; this is specially indicated if the table is heated by hot water. If chloroform has been used as an anæsthetic, 30 minims of ether may be injected with a hypodermic syringe, but the needle must be plunged into a muscle, since, if injected under the skin,

not only is the absorption slower, but a considerable amount of skin round the puncture may slough. Brandy also and caffeine may be injected hypodermically. One of the most powerful methods of diminishing shock is by the injection of about a pint of warm normal saline solution, at a temperature of 110° F., into the rectum ; this should be done slowly in order to insure retention, and before the patient is removed from the table. When the shock continues this may be repeated as often as every hour. Half an ounce of brandy may be added to the enema. The next method of treating shock is by the subcutaneous or intravenous injection of normal saline solution. The subcutaneous method is very popular in France, and it is usual to inject 2 to 4 pints of saline solution subcutaneously during the first twenty-four hours. In some ways the subcutaneous method is preferable to the intravenous, since it does not cause such a rapid dilution of the blood, an effect which may produce imperfect aeration and consequent dyspnœa. It has the disadvantage of being rather painful. The improvement caused by intravenous injection is often very transient, and a second injection has to be made, while sometimes a third or a fourth is necessary. Care must be taken in these injections to keep up the temperature of the saline solution to 105° F. Intravenous injection should be made into the median basilic vein ; the fluid is introduced by means of a funnel attached by rubber tubing to a cannula. The funnel should be held about 3 or 4 feet above the arm, and the fluid allowed to run in slowly. In the case of subcutaneous injection a syringe must be used, and the fluid forced by its means into the subcutaneous tissue, that of the axilla being best adapted for the procedure. Great care must be taken to sterilize the saline solution ; it should be boiled and allowed to

cool, and placed in a clean receptacle, and covered with cotton-wool or a sterilized towel.

Hypodermic injection of strychnine and of digitalin may also be employed, the former being one of the most powerful stimulants at our disposal; $\frac{1}{30}$ grain should be injected, followed by $\frac{1}{60}$ in an hour's time. Not more than three or four doses should be given until after a certain interval. I often order $\frac{1}{30}$ grain of strychnine to be given every four hours during the night after the operation. According to some surgeons, morphia has the power of diminishing shock, since it relieves pain which by itself may be a cause of shock, and sterile ergot extract is also credited with the power of reducing shock.

Nursing.—Stomach or intestinal abdominal cases must never be left entirely alone. Although I do not remember ever having ordered special nurses for a case, in private I find it necessary to have two nurses for the first week, so that the patient may always have one with him. No special qualification is required for the nurse; she must be a good surgical nurse, and must be able to pass a catheter on a female without disturbing the patient, and must also be skilled in giving nutrient and aperient enemata. She must also never act on her own initiative with regard to feeding, but implicitly follow the directions which are given. One of her chief duties is to prevent bedsores, and so particular care must be taken that the back of the bandage does not get wet, either when the patient passes urine, or after an enema. If so, a fresh bandage should be immediately applied. The nurse must take the temperature and pulse-rate every four hours, and must keep a detailed diary of the exact amount of nourishment and of stimulants given, and of sleep taken during the day. The pulse is of special

importance, and I pay more attention to it than to the temperature, since I regard a rapid pulse as an imperative indication for alcohol. There is no necessity to pass a catheter if the patient can pass urine naturally, but if he is unable to do so the catheter must be passed at intervals of not more than ten hours.

Feeding.—The ordinary time to commence feeding after any operation is when the sickness caused by the anæsthetic ceases; but as the stomach is always somewhat deranged by the anæsthetic, easily assimilated nourishment, such as beef-tea and barley-water, are usually given at first. In most severe abdominal operations nothing except teaspoonfuls of hot water are given for the first twelve hours, and then beef-tea and barley-water, or an ordinary cup of tea, are commenced in small doses, $\frac{1}{2}$ to 1 ounce being given every two hours. Milk I consider is unsuitable to commence with, as it forms clots which are apt to irritate the stomach, and so cause further vomiting; it should, therefore, only be given to patients who object to beef-tea or peptones, and should then be peptonized.

A case of operation on the stomach should be treated in a similar way to any other severe abdominal operation. If there is no sickness feeding is commenced by the mouth about twelve hours after the operation. I usually give $\frac{1}{2}$ ounce at a time every two hours, and give barley-water and beef-tea, or Valentine's extract, etc. On the following day the amount given by the mouth is increased to 2 or 4 ounces every two hours. On the second day the quantity of food is increased to 5 ounces; an egg and a little wine are added to the dietary. On the third day custard pudding and jelly are allowed. Benger's or other malt food is added, and on the sixth day milk, tea, etc., are given. On the fifth day fish is given, and

chicken immediately afterwards. This, of course, is for an uncomplicated case.

It will be interesting to briefly refer to methods of feeding serious stomach cases recommended by other surgeons. MM. Terrier and Hartman's directions are as follows : The subcutaneous injection of saline solution is to be carried out during the first twenty-four hours, and longer if necessary, and in severe cases it is continued for five days, from 600 to 2,000 grammes being injected each day. Nutrient enemata are given for the first twenty-four hours, and in severe cases for as long as twelve days. If there be no sickness on the day after the operation the patient can have champagne or brandy-and-water by the mouth ; they give peptones and milk on the fourth or fifth day, then eggs, and on the seventh day calves' brains, after which fish or chicken is allowed.

Stimulants.—In most cases stimulants will be required from the first day ; it is usual to add some brandy (2 drachms) to each nutrient enema on the day of the operation, and if the general condition of the patient is good no further stimulant will be required till the third or fourth day, when solids are given by the mouth ; then a little champagne with the principal meal is indicated. In a case where there is considerable shock, however, stimulants must be pushed earlier, and in deciding upon this point, and also on the quantity to be given, I am guided by the pulse. A rapid pulse demands stimulants, and if necessary they may be pushed to a very large amount ; thus I have kept a patient alive for a month after a serious operation by giving each day 16 ounces of brandy and 18 ounces of champagne. Some surgeons, as a routine, commence on the evening of the operation by giving iced champagne or iced brandy-and-water ; the former, however, does not seem to be desirable

after an operation on the stomach, as it tends to distend the organ with gas. Brandy, therefore, is to be preferred, and for a similar reason should not be mixed with soda-water; other stimulants given are rum, red wine, and beer. The last-named is very useful when the patient expresses a wish for it, since the malt which it contains is of some nutritive value; it also acts as an aperient. In France the stimulant is usually diluted with Vichy water, but this is not essential.

Management of Bowels.—In abdominal operations, not only is it advisable to clear out the intestine thoroughly before the operation, but the bowels should not be allowed to become constipated after the operation. Especially when nutrient feeding is employed it is necessary to wash away the unabsorbed residue each day. In every abdominal case our wish is to prevent any stasis of the intestinal contents due to the temporary paralysis of peristaltic action caused by injury, or the application of irritating antiseptics, and we must use every endeavour to re-establish the normal peristalsis as soon as possible.

One reason for the early opening of the bowels is the avoidance of the condition known as pseudo-ileus, which is a form of intestinal obstruction brought about by paralysis of the gut from exposure or injury, and is often combined with the formation of adhesions in such a position as to cause a kink. The condition is fairly common in operations on the lower part of the abdomen. It has often been confused with peritonitis, and has led to the idea that peritonitis is cured by purgatives; there are, however, no signs of peritonitis post-mortem in fatal cases. Pseudo-ileus differs also from other intestinal obstruction by its rapidly fatal course if unrelieved, death being probably due to the migration of the *Bacillus coli communis* from the paralyzed gut into

the peritoneal cavity, and by the absorption of its toxins therefrom. In order to guard against this condition, which arises from paralysis of the gut, as well as for other reasons, our aim must be to re-establish the normal peristaltic action as quickly as possible. The first means by which we attempt to do this is by the passage of a flatus tube about 4 or 5 inches up the rectum every four hours; this enables the gas to be expelled by the enfeebled peristaltic contraction, which would otherwise not have sufficient force to conquer the resistance of the anal sphincter. Early feeding, too, will help our object, and hot fluids by the mouth, together with the avoidance of ice and of milk, are more conducive to the production of peristaltic action than starvation and ice. The most important point, however, is to obtain an early action of the bowels by means of an enema. This should be given on the second or third day after the operation, and may contain some purgative drug in addition; a list of some of the purgative enemata is given below. Some surgeons recommend a purge as well—thus Spencer gives calomel on the second day—but I am inclined to rely first on the action of enemata, and to give a purge by the mouth only if the enemata are unsuccessful. In such a case I give 2 grains of calomel, followed by an ounce of *mist. sennæ co.*, or a pill containing calomel and colocynth, or an ounce of *mist. mag. carb.* with *mag. sulph.*, to be repeated every two hours. In cases where aperient medicine cannot be given by the mouth in consequence of vomiting, and no result has followed a simple enema, we must rely upon the use of purgative enemata, the most useful of which are the following:

1. *Ol. ricini*, turpentine, of each 1 ounce in 10 ounces of thin gruel.
2. The British Pharmacopœia *enema terebinthinæ*,

containing 1 ounce of turpentine to 15 ounces of mucilage of starch. Both these preparations, however, are rather strong, and I usually employ an enema of 1 pint of gruel containing 1 to 2 drachms of turpentine.

3. Enema sulphate of magnesia (or enema catharticum, B.P.): ℞ of sulphate of magnesia 1 ounce, olive oil 1 ounce, mucilage of starch 15 ounces.

4. Enema of aloes (B.P.): Aloes 40 grains, carbonate of potash 15 grains, mucilage of starch 10 ounces.

5. Enema of colocynth contains ext. colocynth $\frac{1}{2}$ drachm, soft soap 1 drachm, water 1 pint.

6. Enema of glycerine 1 to 2 drachms injected undiluted, or in the form of a suppository. This latter, however, is not of much use immediately after an operation, and may cause tenesmus.

A good number of cases of operations on the stomach never require any aperient, and the bowels act naturally on the second or third day; in some cases also the other extreme is reached, and very troublesome diarrhœa follows, which has caused a fatal issue in several cases without leaving any signs at the post-mortem. In such cases the amount of liquids given should be diminished, and tincture of opium must be given by the mouth, and the stomach washed out; this will usually suffice to stop the diarrhœa.

Rectal Feeding.—As rectal alimentation may be required in abdominal operations, some account of the best form of carrying this out will be useful. In the first place, before commencing nutrient enemata it is best to thoroughly wash out the bowel with normal saline solution; this must be repeated each day to remove the débris. A nutrient injection should be given to the patient when lying on his back, and he should not change his position for some time after the injection. The best

method of introduction is to use a soft rubber rectal tube the size of a 12 or 14 catheter, which should be passed about 6 inches up the rectum ; connected with the tube is a funnel, which should be raised 2 feet above the bed. This is better than a syringe, since the fluid will flow more evenly and slowly into the rectum, and so is more likely to be retained ; the risk of forcing in air, too, is diminished. The whole enema should not exceed 6 ounces in bulk, and in cases of irritable rectum only 3 or 4 ounces should be given ; it should be of a temperature of 100° F., and should be given every four or six hours. Practically only substances in solution can be absorbed from the rectum, so unpeptonized milk or beef-tea are useless ; stimulants, such as spirits, wine, tea, or coffee, are most readily absorbed ; extractives and peptones are also of value. The necessity of giving digested meat has been recognised for a long time, but the process of preparing the enemata has been much improved by the introduction of the various peptonizing and zymizing powders now on the market. The older enemata were prepared with fresh pancreas. The following are a few of the best :

1. The enema which I have been in the habit of using is made as follows : Milk 2 ounces, strong beef-tea 2 ounces, yolk of one egg, liq. pancreatin (Benger) 1 drachm. This is to be prepared one hour before use, and to be kept at a temperature of 100° F. Half to 1 ounce of brandy is added, when necessary, immediately before use.

2. *Von Leube's*.—Five ounces of finely-scraped meat are chopped very fine, and to this is added 1½ ounces of finely-chopped pancreas ; the whole is suspended in 3 ounces of lukewarm water, and stirred to the consistence of a thick pulp. This makes one injection.

3. *Mayet's*.—One hundred and fifty to two hundred grammes of pancreas are bruised in a mortar with tepid water at a temperature of 100° F., and are then strained through a cloth; 400 to 500 grammes of lean meat are chopped fine, and the strained pancreatic fluid is mixed with the mince, together with the yolk of one egg. This is allowed to stand for two hours, and administered at the body temperature; the quantity is sufficient for twenty-four hours' nourishment, and should be administered in two parts.

4. *Rennie's*.—Half a pound of lean meat is pulled into shreds and added to a pint of beef-tea; to this is added 1 drachm of fresh pepsin, and $\frac{1}{2}$ drachm of dilute hydrochloric acid; the mixture is kept at a temperature of 99° F. for four hours, during which it is stirred constantly. If too great heat be employed the digestion will stop.

5. *Terrier and Hartman* recommend the following: Peptones 20 grammes (1 drachm), infusion of tea 100 grammes (4 ounces), benzo-naphthol $\frac{1}{2}$ centigramme, tinct. opii 5 minims. Four of these are given during the twenty-four hours.

6. *Greig Smith's*.—One egg is beaten up in 6 ounces of milk, and two or three teaspoonfuls of meat jelly or peptones added. This is administered warm with or without $\frac{1}{2}$ ounce of brandy every five or six hours.

7. *Hunter Robb's*.—Peptonized milk 1 ounce, whisky $\frac{1}{2}$ ounce, the whites of two eggs, common table-salt 14 grains.

Nutrient suppositories are also used when the rectum is intolerant of injections, or they may advantageously be used alternately with them in cases requiring several days' rectal feeding. If used alone they must be supplemented by an injection of about $\frac{1}{2}$ pint of hot saline solution once or twice a day. The suppositories are

usually made of peptonized beef, a chocolate-coloured paste, which is prepared by digesting beef with acidified fresh gastric juice, and then concentrating the solution. Each suppository contains 30 grains of this, and is stiffened with cacao butter. These suppositories are made by most wholesale chemists, and keep for only a short time after the box is opened. It is best to use them as freshly prepared as possible.

Lastly, *Sansom* has recommended the use of blood as an enema. Ox blood is usually employed, and must be defibrinated first; this can be got from a butcher by asking for whipped blood. It must be fresh, and will not keep more than one day. By the addition of $1\frac{1}{2}$ grains of chloral to 1 ounce of blood all offensive odour is prevented. It is usual to inject 2 or 3 ounces of blood every two or three hours. Personally, I have had no experience of the method, but its introducer reports favourably of it.

In cases where rectal feeding has to be continued for any length of time it is well to change the composition of the enemata, since the rectum does not appear to retain any one kind of enema after a time. If, too, the rectum be irritable, 2 or 3 minims of tinct. opii should be added to each enema. Some surgeons also add some disinfectant to each enema, either beta-naphthol or salol; from 2 to 5 grains of either can be given. Alcohol also acts as a disinfectant as well as a stimulant, which is an additional reason for adding either brandy or red wine.

Lavage.—If vomiting and eructation continue after the second day, and especially if at the same time the temperature be elevated, the mouth dry, and the tongue sticky and coated, it is almost certain that there is some decomposition of the stomach contents. If these contents

be allowed to remain in the stomach they will probably produce a fatal issue, either by setting up diarrhoea, by keeping up vomiting, or by absorption of toxins. It is very important that they should be removed at once. To do this a stomach-tube must be passed, and the stomach thoroughly washed out with some antiseptic, such as salicylic acid, followed by plain boiled water; this must be continued until the fluid returned is quite clear. Feeding must be recommenced immediately after the lavage, as this will be a favourable time for the absorption of some nourishment. The lavage must be repeated on the next day if vomiting or eructation continue. In some cases it may require to be done daily for five or six days.

Some hesitation might be felt at passing a stomach-tube forty-eight hours after suture of the stomach, and injecting water to wash out its contents, since this might place a strain on the stitches; however, it is far better that a suture should undergo a slight strain than that it should be soaked in a putrid liquid; besides, the wound in the stomach is firmly sealed at the end of forty-eight hours, and will practically be as water-tight then as ever it will be. The lavage, of course, must be done gently, the patient lying on his back, and the fluid introduced by means of a funnel which must not be more than 3 feet above the patient's head; it is removed by syphon action, not by expression.

Mouth and Teeth.—As in the preparation before an operation special attention was drawn to the importance of rendering the buccal cavity as aseptic as possible, so also after an operation this point is still worthy of remark. The teeth should be gently brushed with some antiseptic tooth-powder at least twice a day, commencing on the day after the operation, and the mouth rinsed out with

boric solution, or with peroxide of hydrogen. All accumulation of food and sordes should be removed from the gums and teeth by means of a small piece of wool soaked in dilute carbolic or boric lotion. Attention to the state of the mouth is of importance not only in preventing decomposition of the stomach contents, with consequent vomiting and diarrhœa, in preventing septic broncho-pneumonia, which has been a fruitful cause of death after stomach operations, but also in preventing the formation of a parotid bubo, which may lead to suppuration and exhaust the patient's strength.

Position of Patient.—As before stated, the patient need not lie flat in bed after stomach and intestinal operations, especially after gastro-enterostomy, since the escape of contents out of the stomach is facilitated by the patient being slightly propped up. It is unnecessary to state that the patient must not move himself, but must allow the nurses to change his position. This change of position also has an influence on the bowels, since it often relieves the condition known as pseudo-ileus, which has been already referred to.

In a simple uncomplicated case of abdominal section the patient should be kept in bed for fourteen days, and may then be moved on to a couch; but he should not be allowed to walk until the end of three weeks. In hospital practice the patient usually leaves the hospital at the end of a month.

I have not made any mention of peritonitis, since it will only occur after faulty suturing, or where septic material has been introduced either by the surgeon's hands, instruments, ligatures, or sponges. In cases of operation for septic tubal abscesses, or for those connected with the vermiform appendix, peritonitis is a real danger, and may occur after imperfect cleansing of

the cavity; it is best avoided by thorough and prolonged drainage.

There are two other points which require notice : the first is the administration of morphia, and the second is the admission of visitors.

Many surgeons have a great prejudice against the use of morphia hypodermically during the first days after an operation, because it often produces persistent vomiting and delay in the re-establishment of peristaltic action, and consequently pseudo-ileus and adhesions. Other surgeons, especially Spencer, to whom I have referred before, make a rule of giving morphia and atropine every three hours or so, so as to prevent vomiting. I should advise a middle course, and I usually give one hypodermic injection of from $\frac{1}{6}$ to $\frac{1}{4}$ grain of morphia combined with atropine on the night following the operation, since I think that a bad night does far more harm than the morphia. Morphia certainly has a depressing effect, so I do not give another injection until I have evidence of the re-establishment of peristaltic action in the intestines as shown by the passage of flatus *per rectum*. In some cases morphia undoubtedly increases the tendency to and duration of vomiting, but this passes off if no more is given, and, if not excessive, even vomiting is preferable to severe pain and want of sleep.

With regard to *visitors*, after any serious abdominal operation no one should be allowed to see the patient during the first forty-eight hours under any circumstances, except where the case is apparently hopeless. With an unexcitable patient the nearest relative, if a sensible person, may just see him for two or three minutes on the third day, and have a short talk on the following day ; not more than one person at a time, however, should be admitted during the first week. At the end of

a week visitors are a welcome change, and their presence can do nothing but good. During the first week the patient should not be left alone with a visitor, but the nurse should remain on guard. It is wonderful how apparently quite sensible people will attempt to give food to an operation case. At the hospital a patient's friend was caught giving plum-cake to a case of gastro-enterostomy three days after the operation.

INDEX

- ABDOMINAL wall, incisions through, 119
 Acute obstruction from cancer, 106
 Allingham's bone bobbin, 57
 Anastomosis, choice between lateral and end-to-end, 21
 end-to-end, by continuous sutures, 46
 by interrupted sutures, 42
 lateral, 25
 by continuous sutures, 32
 by Halsted's method, 28
 Anatomy of the small intestine, 1
 Anterior gastro-enterostomy, 65
 Antiseptics, intestinal, 136
 Aperients before operation, 135
 Appendicitis, fulminating, 109
 incision for removal of appendix, 113
 removal of appendix in recurrent, 112
 Appendix abscess, treatment of, 111
 points in removal of, 117
 Arrangement of the bed, 146
 of the operating-room, 127
 Artificial anus of large intestine, 102
 of small intestine, 97
 Artificial sponges, 131
- Bed, arrangement of, 146
 Bobbin, potato, Landerer's, 58
 Bone bobbin, Allingham's, 57
 Mayo Robson's, 54
 Borham's method of preparing sponges, 130
 Bowels, management of, after operation, 154
 Button, Murphy's, 59
- Calyx-eyed needles, 7
 Cancer of colon, treatment of, 103
 Catgut, preparation of, 133
 Choice of room for operation, 125
 Clamp, Doyen's, 8
 elastic tubing, 9
 Lane's, 9
 Maunsell's, 9
 Closure of wound of intestine, 21
 of stomach, 63
 Clothing after operation, 136
 Colon, cancer of, 103
 Colotomy, 66
 Comparison between lateral and end-to-end anastomosis, 22
 methods of performing gastro-enterostomy, 74
 methods of treating artificial anus, 101
 Continuous Cushing suture, 17
 Lembert suture, 16
 Mattress suture, 18
 Cushing's suture, 17
 Czerny suture, 12
- Direction of pieces of gut in lateral anastomosis, 25
 Doyen's clamp, 8
 Dressing of wound, 144
 Dupuytren's enterotome, 99
 suture, 16
- Elastic tubing clamp, 9
 End-to-end anastomosis by continuous sutures, 46
 by interrupted sutures, 42
 by Maunsell's method, 39
 Enemata, nutrient, 156
 purgative, 155
 Enterostomy, 84

- Entero-anastomosis, 71
 Enterotome, Dupuytren's, 99
 Ergot before operations, 138
 Excision of intussusception; 94

 Fæcal fistula, 96
 Feeding after operations, 152
 before operations, 136
 rectal, 156
 Fistula, fæcal, 96
 Forceps, Laplace's, 50
 O'Hara's, 48

 Gall-bladder, incision to expose, 129
 Gangrenous hernia, treatment of, 90
 Gastric ulcer, ruptured, method of closing, 63
 Gastro-enterostomy, anterior, 65
 comparison of different methods, 74
 incision for, 124
 posterior, 69
 Gély's suture, 18
 Glover's suture, 17
 Gloves, 143

 Halsted's method for lateral anastomosis, 28
 rubber bag, 52
 suture, 14
 Hernia, gangrenous, treatment of, 90
 Holder for intestines, 43
 Hygiene of the mouth after operations, 160
 before operations, 141

 Ileo-colostomy, 81
 incision for, 124
 Implantation, 83
 Incision for gall-bladder operations, 124
 for gastro-enterostomy, 124
 for ileo-sigmoidostomy, 124
 for removal of appendix, 113
 for pylorotomy, 124
 for pyloroplasty, 124
 through abdominal wall, 119
 method of closing, 121
 Instruments, preparation of, 128
 required for anastomosis, 6
 Internal strangulation, treatment of, 92
 Intestinal antiseptics, 136

 Intestine holder, 43
 closure of wound of, 21
 occlusion of, 27
 Interrupted sutures, end-to-end anastomosis by, 42
 Introduction of Paul's tube, 84
 Intussusception, treatment of, 92

 Jejunum, method of finding, 65
 Joubert's suture, 14

 Knots of suture, position of, 4

 Landerer's potato bobbin, 58
 Lane's clamp, 9
 Laplace's forceps, 50
 Large intestine, artificial anus of, 102
 Lateral anastomosis, 22-32
 Lavage, 159
 Lembert's suture, 12
 Ligatures, preparation of, 132
 Lockwood's method of preparing sponges, 130

 Management of the bowels after operation, 154
 of the mesentery, 36
 Mattress suture, continuous, 18
 Maunsell's method for end-to-end anastomosis, 39
 sponge clamp, 9
 Mayo Robson's bobbin, 54
 Mesenteric stitch, 46
 Mesentery, management of, 36
 Method of uniting peritoneum, 121
 Morphia after operations, 162
 before operations, 139
 Mouth, hygiene of, 141, 160
 Murphy's button, 59

 O'Hara's clamp forceps, 48
 Operation-room, arrangement of, 127

 Paul's tube, 83
 introduction of, 84
 Points in removing the appendix, 117
 Position of patient, 161
 Posterior gastro-enterostomy, 69
 Preparation of catgut, 133
 of instruments, 128
 of ligatures, 132
 of sponges, 129
 of surgeon's hands, 142
 Prevention of shock, 134
 Purgative enemata, 155

- Purse-string suture, 20
Pylorectomy, 78
 incision for, 124
Pyloroplasty, 76
 incision for, 124

Rectal feeding, 156
Removal of appendix, 112
Roux's operation, 71
Rubber bag, Halsted's, 52
Ruptured gastric ulcer, suture of, 63

Saline infusion, 137
Saturation method before operations, 138
Shock, prevention of, 134
 treatment of, 149
Small intestine, anatomy of, 1
 artificial anus of, 97
Sponges, preparation of, 129
 artificial, 131
Sponge clamp, Maunsell's, 9

Stewart-Lewis's saturation method, 138
Stimulants, 153
Strangulated hernia, gangrenous, 90
Strangulation, internal, 92
Subcutaneous saline injection, 137
Surgeon's hands, preparation of, 142
Sutures, 12-20

Tables required in operation-room, 126
Treatment of acute obstruction
 from cancer, 106
 after operations, 144
 of vomiting, 148

Vicious circle, 71
Visitors, 163
Vomiting, treatment of, 148

Wölfer's suture, 14
Wound, dressing of, 144

THE END

